SHOP EQUIPMENT NUMBER

Railway Mechanical Engineer

VOLUME 95, NUMBER 6 — New York—JUNE, 1921—Chicago — ESTABLISHED IN 1832

Published Monthly by Simmons-Boardman Publishing Co., Woolworth Building, New York, N. Y. Subscription price, United States, Canada and Mexico, $3.00 a year; foreign countries, $5.00 a year. Single copies, 35 cents. Entered as second-class matter, January 4, 1916, at the post office at New York, N. Y., under the Act of March 3, 1879.

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Volume 95 June, 1921 No. 6

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EDITORIALS

The Present Situation in the Mechanical Department

THE railroad situation at the present time is a serious one for all concerned. Complaint is heard from the public that freight and passenger rates are too high. Yet despite these high rates the roads are not earning anywhere near the 6 per cent that was set up as a fair return by the Transportation Act. Normally, operating expenses are about 70 per cent of the gross revenue, but during the first three months of 1921 the larger roads on an average spent 92 cents out of every dollar for operating expenses. After paying taxes and rentals, less than two cents out of the dollar were left to pay interest on stocks and bonds. Such a condition could not be allowed to continue very long or a large share of the roads would have been bankrupt. The only alternative was to reduce expenses by stopping all but absolutely necessary work. Maintenance has been curtailed, many shops have been shut down entirely and other drastic economies have been put in force, but even so, many roads are still operating at a loss.

In times of business depression, like the present, it would be desirable for the roads to do more than the usual amount of work, instead of less. There is a great deal of equipment in need of repair and new locomotives and cars should be ordered in large numbers. But so long as the roads are unable to earn a fair return upon the capital invested in them, no one wants to lend them money and they cannot buy. So the first thing needed to get the railroads on their feet and to put railroad men back to work is an improvement in the earning power.

Some Prospect of Improvement

THERE is reason to believe that the roads will soon be in better condition to earn a fair rate of return. The freight traffic has increased slightly in recent weeks and any increase in revenue will permit an increase in the net earnings. However, a heavy traffic alone would not suffice, for during the last four months of 1920, with the new rates in effect, the roads handled the largest traffic ever known at that season of the year, yet their earnings were at the rate of only 3⅓ per cent annually.

It is doubtful whether the volume of business existing in 1920 will soon be restored. At any rate, it is evident that, regardless of the increase in traffic, there must be a considerable reduction in expenses wherever it can be effected. W. Jett Lauck has asserted that a billion dollars a year could be saved by more efficient management without any reduction in wages. This would be highly desirable if it were possible, but when the statement is analyzed, its absurdity becomes apparent. After the Labor Board had granted the wage increase last July and while the railroads were still handling a heavy traffic, their total operating expenses were at the rate of about $6,000,000,000 a year and of this amount almost $4,000,000,000 was paid out in wages. If a billion dollars was to be saved without reducing the payroll, all other expenses would need to be reduced almost 50 per cent. About four-fifths of this other $2,000,000,000 is spent for fuel and for materials and supplies. Railroads are universally known as being very close buyers, and there is no evidence that large sums can be saved in expenditures for material. There has been some reduction in prices during recent months and of course the roads will benefit by them, but not to a very great degree.

In the last analysis, some reduction in wages is inevitable. Fortunately, it is not only necessary; it is also justifiable. The report of the National Industrial Conference Board for May 1 showed that the cost of living was 65.7 per cent higher than in July, 1914, while the peak in 1920 was 104.5 per cent above the pre-war level. The Labor Board has recognized this situation and has announced that wages will be reduced. While such reductions are always unwelcome, the workers have little cause for complaint. There may be fewer dollars in the pay envelope, but they will buy as much in food, clothing and other items as did the higher wage six or eight months ago.

The labor unions in presenting their case before the Labor Board made sensational charges that have received wide publicity. The railroads' side of the case has not been as widely circulated and probably many of the employees have seen little of the evidence except that presented by their organizations and published in the unions' papers. It is important that railroad officers should know both sides and be able to counteract the propaganda of the labor organizations which may tend to cause dissatisfaction over the new wage scale. The rank and file of shop employees are intelligent, reasonable men and there is no reason to question that they will accept the decision of the board in the proper spirit if they are shown that it is necessary and also that it is fair.

Starting Over With a Clean Slate

THE abolition of the national agreements and the reduction of wages make the labor situation at this time particularly important. The first of July will open a new era in the relations between the railways and their employees. The rules drawn up and the precedents established in the next few months will probably determine the policies that must be followed for many years to come. Every railroad officer should be careful to get the right start under the new conditions. There has been too much hiding behind rules in the past; the time has come to see that every man gives a fair day's work for his day's pay. The foreman must deal with the men in a reasonable manner, but he must have the authority to enforce discipline which is necessary for efficient operation. Questions of minor importance must be settled locally and without losing the production of several men over every real or fancied grievance. Both sides should live up to a reasonable interpretation of the decisions made by the Labor Board. What is needed is absolute fairness and more regard for the spirit and less for the letter of the agreement.

More Repair Work Must Be Done

THE new working rules and new wage rates will probably bring about a gradual improvement in the railroad situation, although considerable optimism is required to foresee good times in the immediate future. The railroad situation is dependent on general business conditions and little improvement is expected before August. Eventually, of course, the traffic will increase to its normal volume and then the difficult problem will be to take care of it. Equip-

ment has been going from bad to worse and the shops must soon resume operation on a big scale to prevent the equipment literally falling to pieces. Already the freight car situation is becoming very serious and a car shortage in the near future is not only probable, but inevitable if the present tendency continues.

Bad Order Cars, 14.2 Per Cent

A FEW weeks ago, on April 8, a new record for the number of freight cars standing idle was established when the car surplus amounted to 524,219. At the same time the number of bad order cars was about 250,000, so that actually there were 275,000 serviceable cars not in use. Since that time the idle cars have decreased and bad orders have increased. On May 1 the car surplus was 482,076 and the bad order cars 309,971, making the net surplus of serviceable cars 172,105. On May 15 the idle cars had decreased to 450,164 and the bad order cars had increased to 324,969, the difference being only 125,195, or 46,910 less than on May 1. A surplus of 450,000 idle cars may seem ample to take care of any increase in business, but when the actual surplus of serviceable cars is only 125,000 it is time the railroads took notice of the situation. If the demand for cars continues to increase as it did during the first half of May and if the bad orders also increase as fast, the small surplus of serviceable cars will be exhausted before July 1 and there will be an actual car shortage with over 350,000 idle cars, but all in bad order.

It is evident that present conditions cannot be allowed to continue. The first step must be to reduce the number of bad order cars. There was a time when 4 per cent of unserviceable cars was regarded as a fair figure. When the ratio rose to 9 per cent in 1919, it was considered very serious and prompt measures were taken to reduce it. On May 15 the per cent of bad order cars was 14.2. If these cars required only minor repairs, they could be placed in service with little delay, but this is not the case. More than two-thirds of the total, 231,690 cars or 10.1 per cent of all the freight cars in the country, require heavy repairs.

What is to be done to improve conditions? In the first place, the roads must begin at once to repair the bad order cars. The number unfit for service should not be allowed to go any higher. A careful survey of the heavy bad order cars should be made and those that cannot be operated economically should never be repaired. In times of heavy traffic nothing handicaps operation more than the weak, obsolete car that limps from repair track to repair track and leaves a series of break-in-twos and train detentions along its path. The roads have been struggling along for several years without enough new cars to take care of necessary retirements and the normal growth of traffic and as soon as funds are available, they must secure a large number of cars.

The Locomotive Situation

LIKE the car shops, the locomotive shops have been running on short time and have scarcely kept up with the current demands for repairs. The number of serviceable locomotives stored is abnormally large, being about 12 per cent of the total owned, but some of these are good for only a few months' service. About 19 per cent of the locomotives are unserviceable, and if the resumption of business activity comes quickly, it will be difficult to get the large output to provide the needed motive power.

Shops Are the Neck of the Bottle

THE high percentage of bad order equipment is not entirely a development of the past five months. It is partly a heritage from last year when the business was the heaviest on record and the shops were not able to keep up with the work. The shops were actually the limiting factor in handling the traffic at that time. When business picks up, they will again be overtaxed. The locomotive and car problem is not only a question of equipment, it is also a matter of providing needed shop facilities. The repair plants must be improved to give them sufficient capacity to handle the work. They must be improved to reduce the cost of repairs, to permit locomotives to be equipped with devices to save labor and fuel and to make them adequate to handle modern equipment efficiently. There is reason to believe that there will soon be a revival of activity in the shops and with the resumption of work will come new problems in the management of the personnel and the equipment to get the best results. The keynote of the future is found in the first principle enunciated by the Labor Board "An obligation rests upon management, upon each organization of employees and upon each employee to render honest, efficient and economical service to the carrier serving the public." The June Shop Equipment Number of the *Railway Mechanical Engineer* is intended to point out some of the methods by which efficient and economical service can be obtained and it appears at a particularly opportune time to assist the roads in doing this.

Engine Terminal Development

ONE of the most important problems facing railroad mechanical departments today is the provision of engine terminals adequate in size and equipment to handle modern locomotives promptly and economically. Locomotives have outgrown terminal handling facilities, and many roundhouses that seemed to turn power efficiently ten years ago are now practically obsolete. This point is strongly emphasized in an article on the up-to-date roundhouse, published elsewhere in this issue and containing some valuable suggestions for the improvement of present terminal facilities. There is no gainsaying the fact that new, larger and better equipped engine terminals are needed and it is the consensus of opinion that the equipment should be such as to provide for all running repairs, both light and heavy, thus relieving back shops of this work which so disorganizes shop schedules. The difficulty is that capital is not now available for new terminals and the article referred to is particularly timely, therefore, as indicating capacity increasing improvements which will not cost much to install.

Attention is called to the need for keeping rough finished machine parts in stock, the finish operations only being performed at roundhouses. This insures furnishing the parts at a minimum cost and returning locomotives to service promptly. The replacement of worn-out turntable tractors, machine tools, air tools and jacks, while costing comparatively little, will do much to promote the efficiency of terminal operation. In this connection, the article contains the following striking statement: "The roundhouse is no place for *lame ducks* whether they be machines, tools or men." Reference is undoubtedly made to the all too common practice of transferring obsolete, worn-out machine tools from back shops to roundhouses with the expectation of getting machine work done more promptly and economically. The fact is that a machinist's time at a roundhouse costs just as much as at a back shop and a worn-out tool is as costly at one point as the other. All the refinements of production machines are not needed in roundhouses, but simple, rugged machine tools should be provided, capable of swinging any size of work ordinarily encountered and taking heavy cuts with the required degree of accuracy.

Other items, the need of which is self-evident, but can hardly be overstated, are mentioned in the article and include boilerwashing and refilling systems, monorail, radial and portable cranes, drop pits including engine and tender wheel pits and altered track layouts. The latter, as for ex-

ample making a turntable accessible from both ends of the ashpit, can be made at small expense and often save many locomotive hours a day. In addition, where all terminal movements are made over one or possibly two switch points, emergency outlets should be provided to guard against delays caused by derailments at these points.

Particular attention should be given to the careful inspection and prompt repair of locomotive parts, making sure that all journals and bearings are periodically inspected and oiled. Probably the most important need of all is to develop able, efficient roundhouse forces, willing to co-operate with each other and the transportation departments in making locomotives earn revenue as large a proportion of the time as possible. Men of the required caliber cannot be retained in engine terminal service unless working conditions in many cases are improved. Reasonable working hours and adequate compensation are essential.

Making Foremen Local Managers

IN his paper before the Car Foremen's Association of Chicago, dealing with the car foreman at the outlying point, L. K. Sillcox, general superintendent of motive power of the Chicago, Milwaukee & St. Paul, described some methods employed in the car department which have met with success in building up a close knit organization and which are worthy of the most careful consideration. There are two aspects to the success of these methods which at first sight are almost contradictory in their nature: First, the development of a closer knit organization, all units in which are working towards a common end; second, the development of a spirit of independence and self-reliance on the part of the local supervisors. A little consideration, however, will lead to the conclusion that these two aspects are not at all antagonistic and that in fact one is really corollary to the other.

There is a tendency in all railroad organizations, no less pronounced in other departments than in the mechanical department, to maintain an air of secrecy concerning the policies of the management, leaving local officers and supervisors to carry them out through the issuance of orders and rules which in themselves explain nothing as to the reasons for or the underlying purposes of the policies which lead to their issuance. This blind conduct of an organization depends entirely upon discipline for its success and in doing so it overlooks a big asset in the intelligence of the men in the field who must put these policies into effect. It is this asset which the methods described by Mr. Sillcox have been developed to utilize. The reports which the foreman at each outlying point must make are of no more value to the department management than to the foreman himself and their educational value is increased by the issuance of a monthly bulletin in which the results of similar operations for the road as a whole are summarized, thus giving each local foreman an opportunity to form an accurate estimate of his own relation to the road as a whole. One of the most important results seems to have been the development of a feeling of self-reliance on the part of these local supervisors who are able to manage their own stations in many respects on their own initiative, within the limitations prescribed, rather than to await the urge of official criticism from headquarters. In other words, discipline has been fortified by intelligence and the local supervisors have become local managers.

TRAIN ACCIDENTS INVESTIGATED by the Bureau of Safety of the Interstate Commerce Commission in the last three months of 1920—October, November and December—numbered 34, and the summary of the reports of these investigations—No. 6—has just been issued. The list includes 13 rear collisions, six butting collisions and seven derailments.

COMMUNICATIONS

A Decision That May Be Misconstrued

WASHINGTON, D. C.

TO THE EDITOR:

I notice on page 267 of the *Railway Mechanical Engineer* for April, 1920, an extract from a decision of the Appellate Division of the New York State Supreme Court, headed "Boiler Inspection Act Does Not Apply to Locomotive Cab." This was true before the amendment of March 4, 1915, and inasmuch as this accident to Brown on the Lehigh Valley occurred in January, 1915, prior to the effective date of the amendment, hence the decision quoted. In looking up the full text of the decision referred to, I quote in part:

"The accident happened January 12, 1915, and the case therefore is unaffected by the amendment to the last mentioned statute which became effective later in that year. We think the Act of 1911 has no application to this case. It relates, not to the locomotive, but to 'the boiler of said locomotive.' Clearly not every portion of the locomotive is within the statute. A cab is no part of the boiler and to hold that the floor of the cab is appurtenant to the boiler is not only to stretch the meaning of that word beyond its proper significance as applied to a boiler of a locomotive, and also to inject into the statute a meaning not intended."

I am directing this to your attention for the reason that under the amendment of March 4, 1915, we believe that the cab and all of its appurtenances are a part of the locomotive and, inasmuch as the Locomotive Boiler Inspection Act as amended is commonly known as the Boiler Inspection Act, I thought possibly some of your readers might misconstrue the court's decision and act accordingly, which would bring us in conflict and which we are striving to avoid.

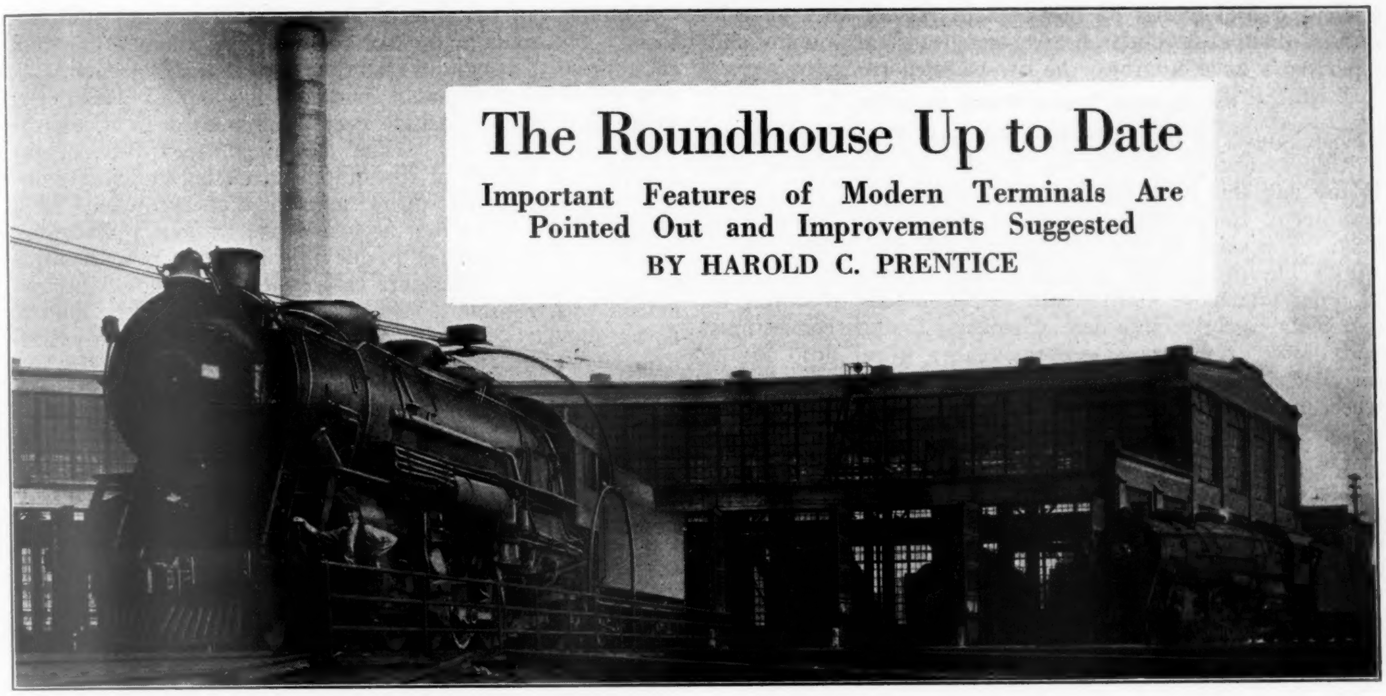
A. G. PACK.

NEW BOOKS

Proceedings of the International Railway Fuel Association, 1920. Edited by the secretary, J. G. Crawford. 480 pages, illustrated, 6 in. by 9 in. Bound in leather. Published by the association, 702 East Fifty-first street, Chicago.

The proceedings of the twelfth annual convention of the Fuel Association, like the foregoing volumes, is a comprehensive and carefully prepared account of the meeting. Probably the most notable feature of this volume is the voluminous paper on Oil Burning Practice on the Atchison, Topeka & Santa Fe, by Walter Bohnstengel. This describes in detail the equipment and methods and gives a complete account of tests of oil fuel conducted by that road, forming a complete and well-rounded treatise on oil burning practice. The report of the Committee on Front Ends, Grates and Ash Pans is of interest because of the discussion of table grates vs. finger grates and the description of the Lewis drafting system. The comprehensive discussion in connection with the report on Pulverized Coal describes results obtained with some of the existing installations of this type of fuel.

The utilization of lignite and sub-bituminous fuels is discussed with particular reference to the carbonizing of lignite. The use of carbo-coal in locomotives is also the subject of an individual paper. Other committee reports deal with fuel stations, feed water heating and an address by E. G. McAuliffe reviews the fuel oil situation. Other features of the volume are the opening address by Roy V. Wright, editor of the *Railway Mechanical Engineer,* and an address by Mott B. Morrow.



The Roundhouse Up to Date

Important Features of Modern Terminals Are Pointed Out and Improvements Suggested

BY HAROLD C. PRENTICE

A Reliable Turntable Designed with a Large Factor of Safety Is Essential

LOCOMOTIVE development during the past ten years has been so marked that shops and roundhouses are in many cases obsolete when they seemed to meet the requirements but a short time ago. What will be expected of the roundhouse of the immediate future? What will be its relation to the back shop and to the railroad in general?

The first duty of the roundhouse is to furnish power to the railroad when needed; the next is to maintain this power between shopping periods. The back shop is designed to make classified repairs and produce standard parts and for efficient back shop operation the adherence to a schedule free from continual interruption by running repair work is essential. It is impossible to draw a hard and fast line between roundhouse and back shop work but it is generally assumed that tires, wheels, driving boxes, shoes and wedges, pistons, piston heads, valve bushings, bull rings, air brake equipment, injectors, lubricators, and all standard small parts will be furnished by the back shop. A still better arrangement is for the store room to furnish this material rough finished and it will then require but minor machining or fitting by the roundhouse organization.

This plan may be illustrated by the renewal of a driving box. Four men can drop locomotive wheels and remove a defective box in about two hours if the equipment is in good condition and there are no unusual circumstances. With a box on hand requiring only boring and facing, it can be placed on the boring mill in the roundhouse machine shop ready for machining as soon as the sizes can be taken, the machine operations being completed in one hour or less. During that time the four men have changed wedge liners or done other work that has developed and are ready to apply the box. In another three hours the wheels are in place and the rods applied, the entire operation including perhaps the renewal of a rod bushing or two, being performed in six hours.

If, on the other hand, the drop pit is tied up with another engine awaiting material and it is necessary to order a new box complete from the back shop the delays mount up. Possibly an engine at the back shop is overdue for wheeling in which case the general foreman does not like to delay matters longer by giving preference to roundhouse work. It also may develop that there is no machined driving box on hand and the new one will require complete finishing from the rough. The only solution is to have in stock at each roundhouse or adjacent storeroom rough finished machine parts ready for application to locomotives as soon as finishing cuts have been taken.

To the uninitiated who are disposed to criticise roundhouse operation the privilege of spending a day in a busy trunk line terminal would be enlightening. It is said that an important government official, having inspected a big but inadequate engine terminal recently, was in a decidedly critical mood all day until invited up into a tower overlooking the yard. There he saw train after train leaving on time with literally scores of engines lined up in turn to back onto other trains yet to go. Criticisms were immediately replaced by compliments. The common defects of old roundhouses are well known; tenders projecting through the doors in zero weather, too short turn-tables with obsolete tractors and mechanics called from inside to push heavy engines around; unhandy track layouts, pits half full of water, obsolete machinery, worn out air tools, jacks, hand trucks, etc.

Careful Inspection Needed

The secret of efficient locomotive maintenance is in periodical inspection and repair of all parts. In fact, this should be the foundation of any plan of operation. A comprehensive schedule of inspection and work, coupled with the regular assignment of mechanics to this duty alone will result in turning out power that will run until the next period with little attention between times. Working conditions will in many cases require a considerable modification if high grade men are to be retained. Leaky roofs, wet floors, poor lavatories and unclean conditions must be eliminated.

There can be no more profitable investment than the modern boiler-washing and refilling system which should extend to every pit. The supply of adequate steam pressure for blower lines and a sufficient supply of compressed air, must be had if repairs are to be promptly made and engines quickly steamed up.

There has been some discussion regarding the installation of electric traveling cranes in roundhouses. In most cases this would necessitate rebuilding but there is room for comparatively inexpensive improvement by installing monorail

trolleys, radial cranes on posts, shop tractors and portable cranes. Pistons, cylinder heads, crossheads, air pumps and other parts have outgrown the two-wheeled truck.

Driving and Tender Wheel Drop Pits

The subject of drop pits is a live one. It is no less than suicide to neglect driving box repairs on locomotives now in use and this work requires adequate drop pit or jacking equipment, conveniently located in relation to the machine shop. The same is true of engine truck and tender wheel work. The practice of uncoupling and jacking up a tender in order to remove a truck and change a pair of wheels is extremely costly in this day of stokers, conduit connections and heavy draw-bars. Once the tender wheel drop pit is installed it will undoubtedly raise the standard of tender wheel maintenance on account of the greater ease of changing wheels.

There is room for improvement in the design of drop pit jacks, especially those intended for driving wheels. The plain air jack is dangerous and is being discarded. The method of supporting a pair of heavy drivers from the center of the axle can be improved upon by an arrangement that will enable the wheels to be dropped and placed back on the floor without leaving the rails. This has been tried out to some extent and should be perfected. Means should be provided to eliminate hand pumping of large hydraulic jacks.

The heart of the roundhouse is the turn-table. There are many terminals so built that the opposite tracks do not line up and when there is no small engine available, it is necessary to uncouple tenders of crippled engines to move them into the house and sometimes the same is required of the engine that does the moving. An inconvenient and somewhat dangerous practice consists of pulling the engine off the table with a cable or chain attached to the next engine. In some cases a windlass operated by the turn-table tractor motor would be of assistance in this work but the installing of a small locomotive for use in the circle is worth many times its cost to any fair sized terminal.

There are many places where quick turns of important power are made, and the turn-table is often held while these engines are in the house for a few minutes. It has been found that the construction of a shed with pits, work benches and a few other accessories will eliminate this delay and in some cases also be available for trial engines coming from the back shop. Many large terminals are constantly being crippled by men waiting a turn-table movement, and the cutting down of unnecessary turns, with the assurance of prompt service when needed will be invaluable.

Machine Tools Needed

The machine shop is deserving of more consideration than commonly given it. It is generally called upon for rush work and several different men may operate each machine in the course of twenty-four hours. Simple, rugged designs, therefore, should be considered in ordering lathes, shapers, etc., leaving the more complicated ones for back shop production work where they can generally be in charge of one or two regular operators. *The roundhouse is no place for "lame ducks," whether they be machines, tools or men.* As to just the equipment needed, that depends upon what and how much work is expected. Assuming that parts are furnished rough machined, the minimum required for a roundhouse turning from eighty to one hundred engines per day and maintaining about forty of them would be one heavy duty radial drill, one small drill press, one 36-inch boring mill, one 36-inch lathe long enough to take extended piston rods or tender wheels, three smaller lathes of different sizes, one 24-inch shaper, one bolt threader, one pipe threader, one 36-inch planer, an emery wheel, a grindstone, a vertical press, a forge and in some cases a steam hammer. One little thought of, but very useful and cheap machine, is the power hack saw.

Nothing can be more important than good and sufficient tools. The roundhouse tool room is just as important and should receive as careful attention as the back shop tool room. The list of what it should contain is too long to catalog, but in a word should include everything needed in doing the work easily and well. The tool room, regardless of the amount and quality of its equipment, cannot function without the aid of proper supervision. The attendant must be a man who will insist that no tools leave without a check and that they will be returned in due time instead of being hoarded in some locker. There are cases where men should be furnished with regular tools and every man should be able to do his regular work without too many trips to the tool room window, but the tools he is to have should be independent

Modern Arrangement by which Locomotives Can Take Water and Coal at the Same Time

of the regular tool room supply and be determined by someone in authority.

It is too often the case that there are not enough work benches and a man must go some distance to find a usable vise. This condition should be remedied. Also, a liberal supply of low platforms, horses, and short ladders will remove the excuse for the dangerous practice of standing on wheelbarrows, trucks and other makeshifts.

The art of electric welding has been developed to a wonderful degree and it is gratifying to note the new installations in roundhouses of electric and oxy-acetylene welding equipment. Defects too numerous to mention are now being corrected without removal from the engine and the spectacle of men trying with hammer and chisel to cut off rusted bolts and nuts in unhandy places is becoming a thing of the past.

The exasperation of being unable to locate a foreman when needed is being overcome in other industries by the use of shop telephones located throughout the plant with signals for every important man. In this manner supervisors are always in touch with each other and the constant running of errands by high salaried men is dispensed with. Some such system should be devised for roundhouses.

Coupled with the subject of adequate equipment is that all-important one, the service of supply. Too much emphasis cannot be given to the importance of having material where and when it is needed. It is the duty of all supervision to anticipate needs for articles not carried in quantities and also to note any excessive consumption. Where storerooms are located at some distance from the roundhouses there should be auxiliaries for terminal needs placed near the machine shops and tool rooms.

Altered Track Layouts

Before an engine can be put in condition for service, it generally must be moved from the receiving point to its place in the roundhouse. The proper location of coaling stations, ash pits, and watercranes will receive due consideration in new construction, but there are many terminals now in existence that can be made to function more effectively with modifications in track layouts. One important terminal was much improved by moving about 75 ft. of track, which made the turn-table accessible from both ends of the ash pit when formerly it was necessary to make all movements on and off the same end when going to the roundhouse. The replacing of an obsolete turn-table tractor by a modern one of sufficient capacity further improved conditions, and the final installation of a 100 ft. turn-table increased the efficiency of this terminal in a marked degree.

Water Pit with Overhead Crane and Side Dump Cars Used for Handling Ashes

At some busy terminals all movements to and from the yard are made over a single switch point. This has often been the cause of hours of delay from derailments at or near this point. There should be at least an emergency outlet. While the financial condition of the railways makes the immediate investment of funds for badly needed terminal improvement uncertain, there are numerous things that can be done without great outlay to improve terminal operations.

Maintaining Locomotives

While no pains should be spared in planning terminal equipment, the fact should not be forgotten that, after all, machines and tools are but one means to the end of keeping locomotives in condition to earn money for the railroads. It is not always the best equipped shop that is the most efficient. To maintain locomotives today requires greater knowledge and more careful supervision than it did a few years back. Present day transportation demands large power units. The cost of fuel, oil, and labor necessitates doing everything possible for its conservation. It is but a waste of good money to install an expensive device and then fail to maintain it.

The superheater increases locomotive efficiency to a great degree provided it receives a reasonable amount of attention. The damper in particular should be kept in good operating condition. Flues must be kept tight and cleaned at regular intervals, all honeycomb and cinders being removed. In blowing flues a pipe no larger than 3/8 inch is used, as others will not work except when directly in line with the fire door. It must be pushed along the flue underneath the unit until it will blow out all accumulation.

The matter of lubrication is often neglected. Box packers, oil cup fillers, lubricator men, and mechanics on engine truck, driver, trailer or tender bearings should be properly trained and duly impressed with the importance of their duties. A hot wheel will tie up the most important engine just as quick and sometimes quicker than less important ones. No foreign matter should be allowed inside the box to work between the brass and the journal. Correct machining, true journals, proper alinement and a little oil on the brass will insure a successful job.

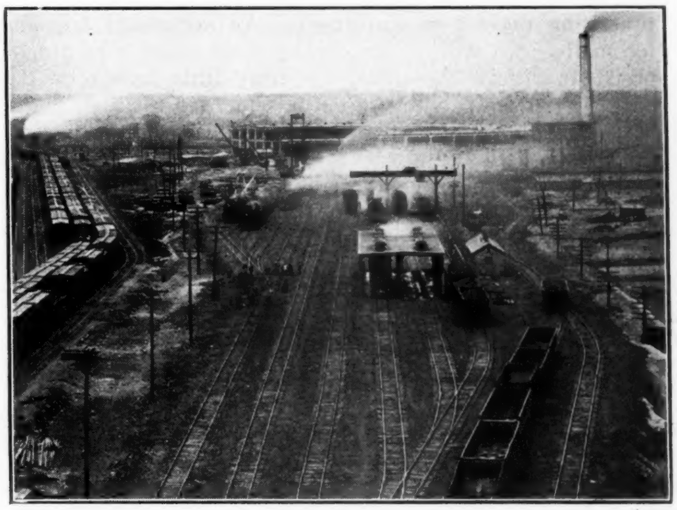
Tender oil boxes in time become worn in the crown and cause unequal bearing on the key. This should be ascertained when the brass is removed and a new box applied. Truck frames will sometimes become twisted and throw the weight on one end of the brass. This will be seen by close observation of the top of the key and may be corrected for the time being by placing a liner between the box and the arch bar on the low end. Many tender wheels that run a little too warm for comfort may be overcome in this manner.

A good box packer will not allow a cellar to run with much opening under the journal, or with waste hanging out and syphoning the oil away but will call attention to the matter. When a driving box is using a grease cake a trip, the fault will be located and corrected. If the rod cup man will see that spindles and dowels are in good condition the rods will run with much less grease and oil. There is no reason for a hot wheel except one—neglect. Careful selection and training of box packers will lead them to discover loose, worn babbitt linings and other defects of bearings and engine failures will be reduced to a remarkable degree.

Men competent to move engines in emergencies when the hostler is busy will reduce the time mechanics often are required to wait for a move. In cold weather there can be no more short sighted policy than that of not having sufficient men on hand at ash pits to clean fires and to watch engines. The delay in consequence of a dead fire or burst feed pipe will cost more than enough to pay for the extra man.

The Time to Cure Engine Failures

The time to cure an engine failure is before, not after it occurs. This is where adequate inspection comes in: to learn to look beneath the surface, to locate the unseen cause, to anticipate a developing weakness. For example, broken tender brake beam hangers or lost brake shoes will indicate a shelled tread or flat spot that in time will cause trouble. When it is impossible to maintain piston or valve stem packing, the trouble may be due to defects inside the cylinder or steam chest. Renewals of piston rod valve stem, cylinder and valve packings should be a matter of separate record for the purpose of noting unusual amounts of this work.



View Showing Covered Inspection Pits, Ash Handling Facilities and Roundhouse Proper

There is sometimes too much detail connected with getting a small job done. The inspector finds a loose nut or two, and goes to the office to report the item. A work slip must be executed and delivered to the foreman and then to the workman who performs the work. The slip is finally re-

turned to the foreman for his signature and then must be checked and filed. This excess of detail is being overcome by the use of inspection pits at the receiving point where the inspector meets the engine and looks it over with the engineer. A small force, properly furnished with small parts, can do the little jobs under the supervision of the inspector and often the engine will not have to go into the roundhouse at all but will be ready for service as soon as the fire is cleaned and coal and water taken. If there are no inspection pits at the terminal in question the idea may be put in practice inside the roundhouse and repairs speeded up to a considerable degree.

The work report clerk as well as the inspector should be on the watch for items reported more than once after they are signed up as being done. This check will make it harder for the slovenly workman to get by. Slips of work undone are to be filed separately until after the boiler is washed when these items will be disposed of. A well kept work report file is a true guide to the condition of the power and to the effectiveness of the organization.

Need for Co-operation

Co-operation and mutual confidence between higher officers, foremen and workmen must be obtained or failure will result regardless of equipment or organization. Roundhouse work is spasmodic to a large extent and cannot be absolutely reduced to routine. In consequence, men are sometimes very busy and then again they may be temporarily unemployed. If at times when a man is out of a job he be permitted to loaf in a specified place that is in sight and convenient, he will be instantly available when the work comes in. He should in no case be allowed to get into cabs or out of sight. Men will, for self protection, hide away when the work is done if experience proves that they will be subject to harsh criticism or unjust discipline from some higher official than the foreman.

The roundhouse must have the support of the engineers and firemen and the only way to get it is by fair dealing and practicing the art of diplomacy. An occasional trip in a locomotive cab will be an education to many who are disposed to criticise these men for every little failure on their part. Friendship with the yardmaster and train despatcher will result in mutual advantage. To learn the viewpoint of the other fellow and to realize that he also is not without his troubles will make smooth many a rough road and be a help in time of trouble.

The very nature of roundhouse work makes it highly improbable that it can ever be easily performed. Men of highest ability are none too good for this important branch of railroading. Reasonable hours, good working conditions, and adequate compensation are necessary to attract them.

Frame Bolt Puller

The manual labor involved in driving out frame bolts by means of a punch and sledge hammer is well understood by all who have had occasion to remove bolts in this way. Another old practice in removing bolts and one which obtains even now in some shops is to shoot them out by means of a gun and powder. This method is more or less dangerous, however, and for that reason usually necessitates waiting until after working hours.

A device which has proved valuable in pulling frame bolts, particularly in difficult places where it would be almost impossible to swing a sledge hammer and where it would be dangerous to operate a gun, has been developed. This device is shown ready for operation in Fig. 1 and is said to require only approximately two minutes to set up and pull a bolt.

The operation of the device will be readily understood from an examination of Fig. 2. Two short rugged arms with inserted hardened jaws *A* are connected loosely by means of the pin *B* and key *C*. Provision can be made for pulling bolts with larger heads by using keys of different thicknesses. A small cylinder *D* is provided with a plunger having a triangular shaped head *E*. This plunger is operated by hydraulic pressure obtained by turning the long screw in

Fig. 1—View of Bolt Puller Set Up Ready for Operation

sleeve *F*. The long screw is turned by an air motor and arrangements should be made for reversing the motor so that the screw can be backed out readily. One of the saddles *G* is applied over the head of the bolt to be pulled and transmits the pressure from the cylinder to the engine frame.

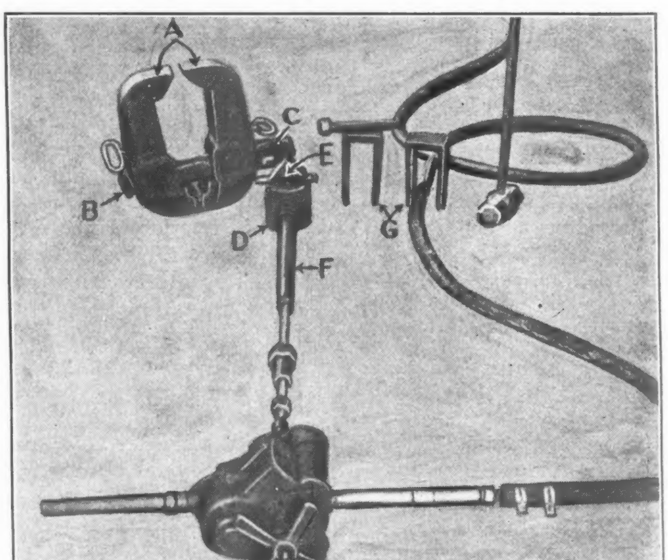
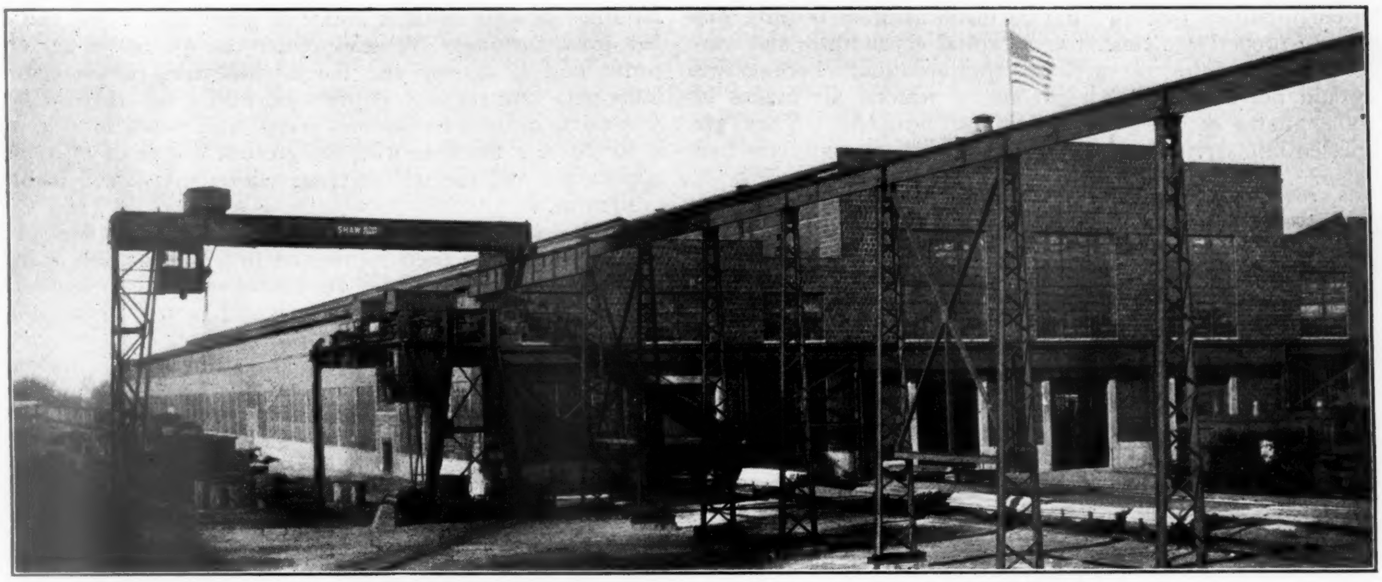


Fig. 2—Details of Device for Pulling Frame Bolts

Referring again to Fig. 1, the method of setting up this apparatus will be at once evident. The operation of the air motor increases the hydraulic pressure in the cylinder, forcing out the triangular shaped head with the following results. The jaws will be pushed together harder and the total force tending to pull the bolt will be increased at the same time.



West Burlington Shop of the Chicago, Burlington and Quincy

Revivifying the Railroad Shop

Modern Mechanical Facilities Will Inject New Vigor and Insure Efficient, Economical Service

BY G. W. ARMSTRONG

HONEST, efficient, economical service is the keynote sounded by the Railroad Labor Board in its recent decision. It sounds the public's challenge to both management and men to secure the best production at the least expense. It is a challenge to management to study and analyze shop facilities with a view to replacing obsolete, wasteful methods and equipment with modern facilities.

An Economic Balance Required for Increased Capacity

Increased capacity will be demanded of the railroad machine in the future. Increased capacity with economical service requires the greatest results from the least investment and the minimum expenditure of labor. Cognizance must be taken of the definite relationship between transportation requirements and the rolling stock and locomotives to handle the traffic. Either new equipment will be needed to provide increased capacity or more effective service must be obtained from existing equipment. The attainment of the most economical service to the public calls for determining the economic balance between the investment in new rolling stock and locomotives, with their attendant burden upon maintenance facilities, and the investment in additional and improved shop equipment and facilities to maintain effectively existing locomotives and cars.

Roundhouses inadequate to promptly turn power and maintain it; repair shops already overcrowded with work, partially filled with obsolete machine tools, are totally unfit to care for repairs to additional equipment. Replaced if necessary, rearranged as required, supplied with adequate modern tools and equipment these revivified shop facilities will accomplish much to secure increased capacity from the present investment. Every equipment unit more quickly returned to service lessens by that much the need for new equipment with its attendant additional carrying charges.

Excuses will not avail. Private management has been said to be on trial. It cannot meet the test unless the equipment can be maintained under the stress of heavy traffic. *What will the future answer?*

Arguments that greater production cannot be secured with improved tools have been used in the last few years with deadening effect on management efforts. Every evasion of responsibility on the familiar pretext: "It can't be done, because of piece-work abolition, national agreements, or what-not," is a psychological stumbling block to results. Private management to survive *must* secure results. Management *will* secure results and modern shop facilities will help supply their answer. Turret lathes or automatic machines must be employed where it is possible to operate them with economy. Modern high power lathes must be installed to replace obsolete, broken-down, slow engine lathes. Facilities in all departments must be improved and adapted to play their part in securing honest, efficient, economical service.

Equip Machines; Don't Merely Buy and Install

Machines alone will not suffice. Accessories, fixtures and jigs, adequate and well designed, must be supplied when the machine is placed in service. It is deplorable to see costly machine tools handicapped for the want of the small additional investment to equip them properly. The lack of a special chuck or fixture to hold the work often means that one-quarter or more of the total time required to finish the piece is needed to chuck it; while with adequate facilities this unproductive time could be cut to one-tenth or less of the total time.

The problem of designing and furnishing these required accessories, fixtures or jigs is often left to the local shop tool-room, which frequently is inadequately equipped even to keep abreast of the maintenance demands of the shop tool equipment. Worse yet is the condition where this work is done locally and charged to the small tool account, through inability to secure authority for purchases at less expense

from qualified tool and fixture manufacturers because this would properly be classed as a capital expenditure and consequently require an executive appropriation. Locomotives would not be purchased without lubricators, air brakes or other parts required to make them complete. They are placed into service ready to perform; why not a machine tool also?

A Vision Required for the Future

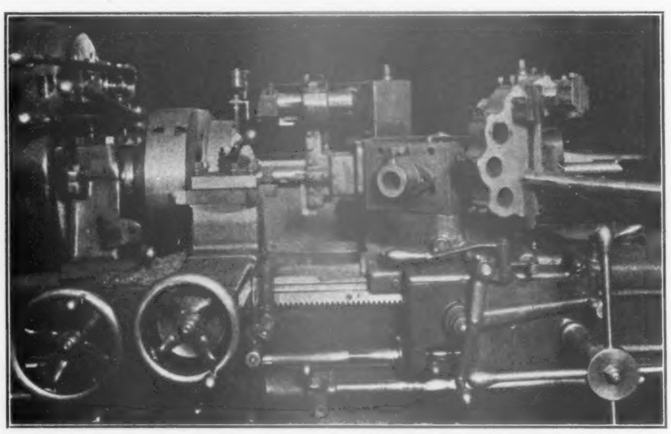
The need of the future is a vision, not of what has been used in railroad shops, but what with profit can be used there. The past decade has been one of intense development in industrial shop facilities. "Oh, my problem is so much different from the other fellow's that I can't use that" should not be a slogan with which the mechanical officer tackles the problem of future facilities. Instead it should be an eager, open minded striving to find out how conditions can be improved, or applications modified so that the best mechanical appliances available shall be employed in the maintenance of railroad equipment to the end that honest, economical, efficient service shall be insured.

The Machine Shop

Of foremost importance in the problem of modernizing shop facilities stands the machine shop. Careful study should be made of the work requirements of each tool to determine whether it is suitable for the purpose, whether it can be adapted to function properly or whether it should be replaced. The final result should be a tool adapted to quickly, accurately and cheaply perform its function in promptly returning equipment to service.

Turret lathes are commonly looked upon as machines for production work only and one or more of them will be found in nearly every shop finishing set-screws, studs and similar parts, which can be turned out far more cheaply on automatic screw machines. There is a field for both and each should be fitted to its place in the economical maintenance of equipment.

Turret lathes can be used with advantage for virtually all chucking work. A large proportion of the engine lathes found in the average shops are used continuously as chucking machines. The turret lathe with a side carriage carrying a turret tool post reduces the time required for changing tools and possesses the additional advantage that if more than one piece is required the stops can be quickly set for at least a rough approximation as to size, allowing quick roughing down with the usual calipering or measuring for finished size. While, of course, production time on a turret lathe requires a reasonable run of similar parts, the lack of quantity requirements does not preclude the possibility of profitable employment of turret lathes.

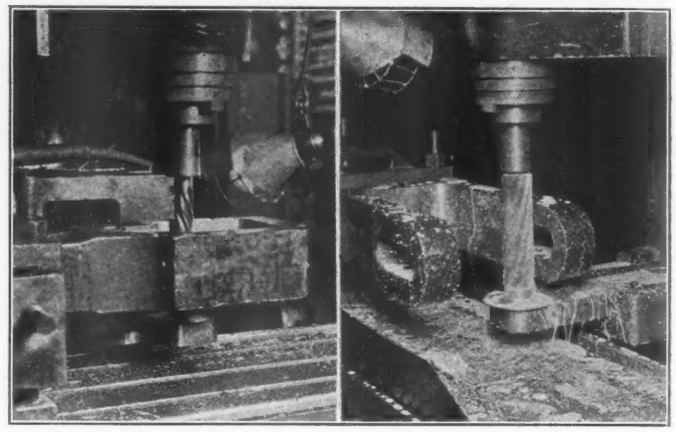


Turret Lathe Tooled to Machine Piston Valve Spiders

One railroad has even found turret lathes advantageous in roundhouse machine shops for finishing rod brasses and bushings as well as other chucking work and miscellaneous bar stock turnings. A dead center can be placed on one turret face if desired and the machine used as an engine lathe with a turret post, if provided with a side carriage.

A point in the selection of a turret lathe worth considering is to secure a machine with the greatest degree of universal application and the widest range with standardized tooling equipment.

Vertical boring mills with side heads and turret tool post boring heads have been introduced to a considerable extent in railroad shop operation. They have especially been found well adapted to driving box boring and facing, piston head and cylinder head repairs and piston and piston valve packing ring production. This type of machine, due to its centralized control and multiple tooling possibilities, combined with a complete cutting lubricant system (little used in railroad shops), has large opportunities as a "cost-cutting" tool.



Truing Main Rod Ends on Vertical Miller

The horizontal boring, drilling and milling machine is an almost indispensable adjunct. Aside from its usefulness on awkward jobs such as machining a steam pipe, its field lies in finishing those parts which require several successive operations, which on this machine can be performed with the same set-up. Thus parts similar to a slide valve steam chest can be quickly and economically finished, as they can be bored for the packing gland, drilled and tapped for the gland studs and faced with a face mill at one setting.

Heavy duty drill presses with cross feed or compound table have been profitably employed in some shops. This type of drill press can be used in many cases with the addition of simple chucking jigs or fixtures to replace engine lathes, boring mills and other machines, aside from its desirability as a rapid production drilling machine.

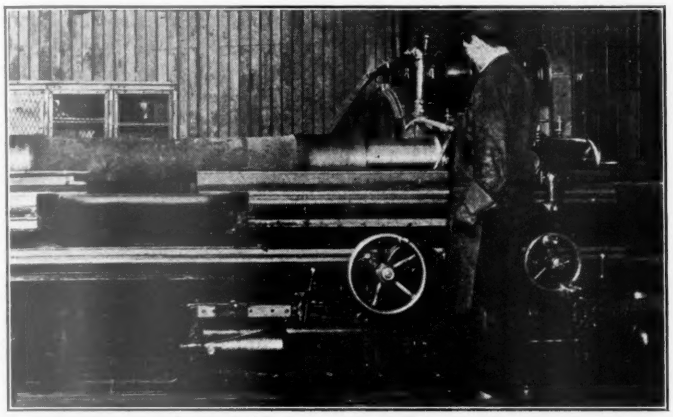
Milling machines are included among the production tools which have been largely neglected by railroad men. Heavy knee type milling machines as well as slab milling machines are available, which are astounding in their accomplishments as "hogs" for metal removing. Stress is too often placed in the avoidance of these machines on the expense involved in milling cutters. Contrasting the finished result and production time with the economy in floor space compared with other machines frequently required for the same work, cost of milling cutters does not become the drawback it is so often considered.

Cast steel driving box wedges have been milled on knee type milling machines in an average time of 15 to 18 min. floor to floor, finished complete as compared with an average of 40 to 45 min. upon a planer, machining the parts in large gangs and requiring three operations with a period of two to three weeks to finish them economically.

Front and back ends of main rods as well as main rod straps have been readily finished by means of a small diameter spiral mill on a vertical knee type milling machine so

that only a slight amount of filing to break the sharp corners was required. The value of the true surface in rods repaired by this method is difficult to estimate, insuring as it does a much better fit of the brasses.

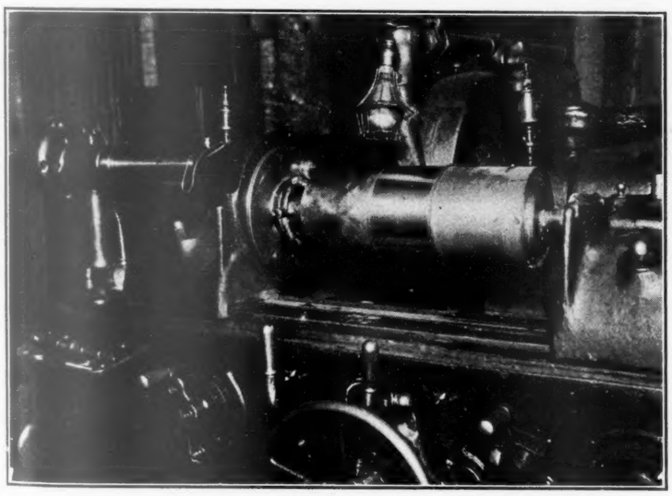
Grinding machines are another class of tools neglected in some railroad shops. The cylinder grinder, cylindrical grinder and surface grinder all have their possibilities, and large possibilities, in efficient and economical shop operation. Accuracy, minimum reduction of metal, superior finish, and workability of hardened surfaces are salient characteristics of the grinding process. Finishing many parts by the grinding



Machine for Grinding Extended Piston Rods, Crank Pins, Trailer and Driving Axles

process permits the reduction to a minimum of rough casting or forging weight which in case a considerable number of parts are used annually involves no mean item of saving. Exhaust nozzles can be ground from the rough casting, valve packing strips can be finished from the rough as well as crank-pin washers, driving box cellars, slide valve faces and numerous other parts without other operations being required.

"Why should I finish by grinding, requiring two machines to handle, when I can finish it in the machine first handling it," is the usual query. If the work is properly prepared to



Truing a Crank Pin on a 10-In. by 36-In. Grinding Machine

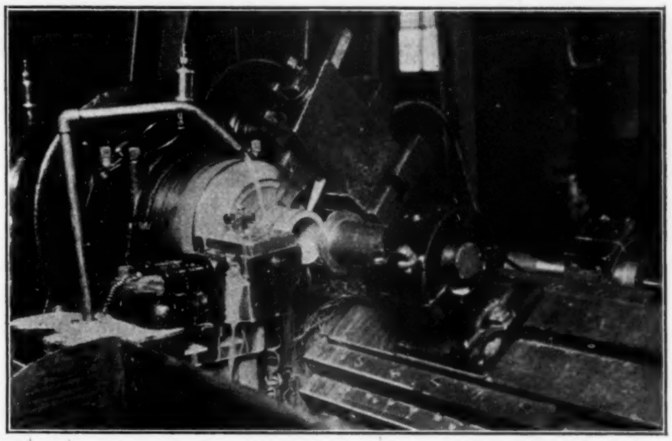
be ground economically, the total production time is reduced. Turned parts to be finish-ground should be roughed out with a coarse feed (proportioned to the diameter) permitting rapid production in finishing.

Aside from any decrease in production time and consequently of production cost, is the accuracy of size control and superiority of finish. A ground surface possesses a greater density than a turned surface, which alone tends to give better service and greater life. Parts cannot be finished as accurately or quickly by turning as they can by grinding.

Ground pins used in conjunction with ground bushings permit of accurately supplying the proper clearance. One road has even considered this element of sufficient importance in motion work maintenance to warrant placing a number of 10 in. by 36 in. plain grinding machines in the roundhouse machine shops.

Cylinder grinders are being used to advantage not only in accurately and quickly grinding holes and bushings which could be bored but also in repairing parts which it would be virtually impossible to finish by any other process owing to the limited thickness of the wall. This type of machine is being used to grind bushings in all kinds of motion work parts, triple valves, knuckle pin bushings, link trunnions, automatic fire door cylinders, and numerous other parts.

Automatic machines have been installed by some railroads. Their possibilities in reducing maintenance cost have as yet, however, been but little appreciated. It is true that to secure the utmost economy from automatic machine operation reasonably long production runs must be scheduled for them but it is not impossible to employ them profitably on what would be considered in commercial work inadequate runs. Even if only one multiple spindle automatic screw machine can be installed in a shop and requires an operator for that machine alone; it is possible to operate it economically.



Single Spindle Automatic Making Motion Work Bushings

Conservatively estimated, three times the production of a single turret lathe can be secured from one four-spindle automatic machine. Allowing for excessive loss of time to set up for short runs of work, and even idle time on the part of the machine, it is possible to secure an output equivalent to two turret lathes. Supplementing a multiple spindle automatic screw machine for small bar-stock work such as studs, rod dowels, etc. with a larger size single spindle automatic screw machine for motion work pins, bushings and other kindred parts, it can be readily seen that with one operator for these two machines the possibilities for economical operation are very much increased.

Automatic chucking machines virtually duplicate turret lathe chucking practice as far as set up and tooling are concerned. The main modification lies in the mechanical performance of the work cycle rather than the manual performance, thus permitting one man to operate two machines. This type of machine can be used very advantageously for finishing air pump piston heads, piston valve packing rings, oil cup covers, crank pin washers, front end main rod washers, boiler check bodies, valves, and similar parts.

Heat Treatment of Tools

To realize the benefit of modern machine tool equipments it is essential that proper heat treatment of the necessary tools be secured and that this heat treatment is directly under the control of the toolroom foreman. Pyrometers should be

used to measure the heat, the scleroscope to check the degree of hardness and easily controlled heating and drawing furnaces used to insure uniform, satisfactory results. Gas furnaces can be mechanically controlled to maintain a uniform temperature while there are a number of good electric hardening furnaces on the market giving a very delicate range of control.

Blacksmith Shops

Drop hammers—Standardization of parts and the reduction of weight of parts are both in line with progressive equipment design and maintenance economy. Standardization makes the drop hammer possible while the use of drop forgings as a substitute for castings permits reduction in weight without sacrificing strength. It is possible by the drop forging process to secure greater strength with less metal than by any other forging process. Much of the work suitable for drop forging can be done with the forging machine. But as stated, drop forging makes possible in many cases a reduction in rough forged weight, and also frequently the production of an article requiring little or no machining to prepare it for use. Crank pin collars can be readily forged, requiring only to be surface ground on one or both faces to be used. Oil cup covers, coal picks, cylinder cock valves, rod keys, all can be drop forged under a drop hammer not larger than 2,500 or 3,000 lb.

Hammer Heading Machines—Many of the bolts used in large quantities in car repairs and in considerable quantities in the locomotive department can be more cheaply manufactured by hammer heading machines having increased capacity over the average type of forging machine. Supplementing improved heading methods with modern, properly designed, high-speed thread cutting machines, bolts can be produced with less expense, with better shaped heads and accurately cut threads, which will insure greater holding power.

Bolt Turning Machines—There is also another large field for development in the production of bolts. With careful study, the use of a tapered bolt, and the maintenance of standard gages and reamers, it is possible to effect large economies in the cost of fitted bolts besides insuring a better fit because of an accurately turned bolt and a properly reamed hole. One man can operate a four-spindle bolt turning machine, and allowing for time lost in setting bolt turning heads, regrinding cutter blades, idle time, etc., it is possible to turn out at least twice as much work as by the usual bolt turning lathe.

The Boiler Shop

Hand flanging of sheets is the method still used in a great many boiler shops. The expense of large, powerful hydraulic flanging presses cannot be justified in the average shop, owing to the excessive overhead charges and the restricted use. Nevertheless, it is possible to virtually eliminate hand flanging of boiler sheets and oftentimes car sheets. By means of a pneumatic flanging press all outside flanges can be finished on flue sheets, door sheets, other boiler parts and car shapes. An additional advantage is that sheets as thick as 3/8 in. or 1/2 in. can even be flanged cold. Inside turned flanges such as door-holes still, however, require to be flanged by hand unless some type of hydraulic press is available, owing to the large throat of the machine required to take in such work combined with the sharp radii of such flanges.

New and heavier locomotive equipment has introduced a problem in a large number of shops in the preparation of boiler sheets. Existing shears and bending rolls have been found of insufficient capacity to take care of the heavy plates demanded for large power. New and larger bending rolls furnish the only answer to one need. Shearing problems, however, can be solved by the introduction of new methods, which are receiving wide consideration in the plate and boiler construction field and have been introduced to some extent by at least one railroad. Mechanically-actuated traveling gas cutting torches have proven very efficient in shearing these large parts. The torch is fed along mechanically at a uniform rate, and it is possible to secure an edge, either beveled or at right angles, which is smoother than the average sheared edge. Other mechanical and pantograph devices are available for trimming the flanged sheets to a beveled edge to facilitate caulking or for cutting out sheets of irregular shape.

Electric Spot Welding—Ash pan assembling has been simplified in at least one railroad shop by the use of an electric spot welder. This reduces the work of laying out and punching holes for rivets and riveting, to the one operation of spot welding with the machine. The electric spot welder has also been used successfully in assembling locomotive jackets, various kinds of tinware, etc.

Welding Tubes and Flues—Another application of electric welding which has as yet been little employed is the butt welding of tubes and flues. This insures a good, sound weld, permits the welding of safe-ends of any length, gives a compact and clean outfit, comfortable for the workman to handle, and heats the two abutting ends to a welding heat in the full view of the operator. Another interesting characteristic is that it refuses to weld tubes which have become too thin, as the tube will burn before the standard safe-end is brought to a welding heat.

Another important development in flue welding is the use of a machine holding the flue rigidly clamped and applying the pressure to weld flues with an expanding roller. This method of welding has been found very efficient and leaves a flue which is perfectly smooth inside and outside. It also permits the reclaiming of old flues by welding a flue of considerable length to the portion of the original flue left after removing the safe-ends.

Complete Modern Tool Heat Treating Department

Car Department

Progress in the car department has been marked by the construction of shops equipped with overhead traveling cranes and electric hoists to facilitate the repairing of cars. In addition there is growing recognition of the necessity for ample equipment of radial drills, bulldozers, forging presses, and punching and shearing machinery to adequately take care of the needs in this department. The greatest need in this field is for the further development of well-equipped car repair shops, permitting repairs to be made wholly under cover during inclement weather.

Among the developments, as yet limited, is the use of

portable electric drills to relieve overloaded air compressor units. Compressed air distribution involves large losses in power owing to frictional resistance in air flow through piping systems, leakage, water content, at least under some weather and temperature conditions, and the inefficiency of the power units (compressor and hammer or motor); making it the most expensive power transmitting medium available in shop operation. Pneumatic hammers must still be used for riveting steel cars. Pneumatic motors can be replaced by electric drills, increasing the potential riveting capacity of the car repair yard or shop; and employing a cheaper power medium and one transmitted with greater effectiveness and decreased power loss.

Mechanical Handling Devices

Mechanical handling devices have not received the consideration which they warrant, in view of the high wages and poor control of common labor. Roller conveyors have been used to advantage in some shops for handling car journal brasses from the tumbling barrels to the boring machine, from the boring machine to the lining table and thence to the inspection table or loading space. Other small units have been used with advantage in transferring work requiring two operations from one machine to the other without the necessity for handling by other workmen.

Electric Tractor Hauling Bolt Wagon Train

For handling sheets while punching or shearing, an interesting adaptation of roller conveyor has been installed in car shops. Standards made of about 1¼ in. pipe have been embedded in the concrete floor spaced about 30 in. to 36 in. apart. In the upper ends are inserted roller casters capable of rotating through 360 degrees to permit easy movement and swinging of the sheet. The height from the floor to the top of the roller caster is of course the same as the working height of the machine throat. The average sheet brought from laying out or other operations by the traveling crane and placed on these rollers, can be readily handled by the machine operator without assistance.

Portable belt conveyors have been used for unloading and transferring brick, sand, coal and other materials around shops and storehouses. These machines can be supplied with electric motor or gasoline engine drive and are therefore suitable for use anywhere desired. Portable mechanical hoists are available, which can be used with profit in stacking material in the storehouse and material yards. Elevating motors, placed on a bracket or suspended from the ceiling, are also extremely handy.

Electric and pneumatic geared hoists have a wide range of application in handling material from the floor to the machine. They are quick acting, safe and easily controlled, permitting close adjustment in hoisting height. Monorail traveling electric hoists are very desirable for handling material from casting storage platforms, car wheel and axle storage platforms and other places to the machining department. They have also been found very advantageous for the transfer of material around through the shops which would otherwise require to be trucked from one electric traveling crane to another.

Electric industrial trucks and tractors have been found to be very profitable. One railroad repair shop has even found it advantageous to install suitable concrete walks connecting all shops to facilitate the use of these electric trucks.

The tractor possesses a decided advantage in that trailer trucks can be used suitable for the need of the particular material to be transferred. In addition they can be taken with the material to the machines or storehouse and the material disposed of without additional wasteful handling.

One shop has devised an interesting series of trailer wagons for use in its bolt manufacture. A flat top wagon with stakes at the ends is used to receive the blanks at the shears eliminating handling at this point. When forging the bolts they are taken directly from these wagons, placed convenient to the forging furnace, and as headed dropped into hopper wagons in which they are transferred to the bolt cutter. As cut they are dropped into an empty hopper wagon placed on the opposite side of the bolt cutter and are ready for transfer to the storehouse. Throughout the entire process of manufacture advantage is taken of the necessity for the workman to handle the pieces to load and unload them.

Electric industrial trucks equipped with cranes will be found especially adaptable for some uses, in particular roundhouse material handling or other places where hoisting facilities are not available or difficult to use. Heavy castings, locomotive or car parts can be frequently removed from place, put on the machine, transferred and replaced by means of this type of truck, requiring a minimum of common labor.

Conclusion

It would be impossible in the foregoing to give any specific remedy for revivifying railroad shops. Weak and strong points on different railroads and in different shops on the same road are so at variance that a general treatment can only sketch some of the means available for solving the problem. Each individual condition requires different treatment; each individual need must be carefully studied with the fundamental guiding principle of striking the economic balance between shop capacity and motive power or rolling stock in enlarging railroad traffic capacity to the end that honest, efficient, economical service shall be insured to the public.

There is given below a list of some of the more important articles which have appeared in the *Railway Mechanical Engineer* covering more fully the subjects which have been briefly discussed in the foregoing article.

GENERAL SELECTION OF MACHINE TOOLS:
- The Selection of Machine Tools....................Page 292, June, 1917
- The Selection of Machine Tools....................Page 89, February, 1916

AUTOMATIC MACHINES:
- Automatic Machines an Aid to Economy............Page 344, June, 1920
- Automatics in Railroad Shops......................Page 303, June, 1919

GRINDING:
- Economies Possible by Car Wheel Grinding..........Page 355, June, 1920
- Grinding in Locomotive Shops......................Page 629, November, 1918
- Plain Cylinder Grinding Work......................Page 641, November, 1917
- Grinding and Milling Work.........................Page 309, June, 1917
- Grinding Car Axles................................Page 152, March, 1912

MILLING:
- Milling Practice in Railway Shops.................Page 521, September, 1918
- Plain Knee Type and Similar Milling Machines....Page 41, January, 1918
- Milling in Railroad Shops.........................Page 321, June, 1917
- Grinding and Milling Work.........................Page 309, June, 1917
- Milling Machine Efficiency........................Page 593, November, 1914

HEAT TREATMENT OF TOOLS:
- Heat Treatment of Steel in the Toolroom..........Page 39, January, 1920
- Modern Tool Room Heat Treating Plant.............Page 389, June, 1920
- Methods Used in Heat Treating Steel...............Page 236, April, 1920
- Heat Treatment of Steels..........................Page 655, October, 1920
- Electric Furnaces for Tempering Tools............Pages 423, August, 1916
- Tempering Tools with the Electric Furnace......Page 590, November, 1915
- Types of Pyrometers and Their Uses..........Page 663, November, 1919

ELECTRIC SPOT AND BUTT WELDING:
- Spot Welding Railroad Tinware.....................Page 151, March, 1919
- Operation of a General Flue Shop (describes electric flue welder) Page 653, December, 1916

BOLT MANUFACTURE:
- Bolt Manufacture in Railway Shops..............Page 465, August, 1918
- Turning Engine Bolts..............................Page 193, April, 1915

MISCELLANEOUS:
- Power Tests of Machine Tools......................Page 294, June, 1917
- Accuracy in Locomotive Repairs..............Page 673, December, 1918
- Micrometer Calipers in Railway Shops........Page 597, September, 1920
- Case Hardening of Steel...........................Page 675, November, 1919
- Case Hardening of Steel...........................Page 731, December, 1919
- Cutting Cost of Exterior Car Cleaning............Page 460, August, 1918
- Machining Car Wheels and Axles.................Page 453, August, 1917
- The Bulldozer in Railway Shops...............Page 77, February, 1913

Economic Advantages of Large Freight Locomotives*

A Thorough Study of the Effect on Various Items of Expense Is Necessary to Determine the Most Suitable Type

BY A. F. STUEBING
Managing Editor, *Railway Mechanical Engineer*

PROBABLY the briefest presentation of the advantages of large locomotives is that made by James J. Hill: "Receipts are by the ton and passenger mile; expenses are by the train mile." It is not to be expected that such a general statement will hold good in all particulars, nevertheless it is true that a large proportion of operating expenses decrease as the train load increases, although not in the same proportion as the decrease in train miles. Under the operating conditions existing on most of the main line mileage of this country, the greatest possibilities for economy probably still lie in the adoption of locomotives of high capacity.

The large locomotive, designed merely for high rated tractive effort, is not a panacea for operating troubles. The first requisite is a design suited to the conditions of the operating territory, the traffic and the service. The relative advantage of specific designs is a problem in the economics of operation that must be solved by the application of engineering principles. It is a question of adapting the design to the operating and economic conditions and then co-ordinating the motive power with other facilities. The last requirement is of great importance for unless all the varied operations can be kept in step, the machine as a whole cannot run smoothly.

The adoption of improved motive power should be only one part of a co-ordinated program. Every appropriation for larger engines should carry with it, as an integral part, provision for facilities to insure the maximum utilization of the power. Engine terminals, shops, yards, the rolling stock and the track structure itself should be prepared to assist in obtaining the proper operating results. The co-ordination of facilities deserves careful study.

The Selection of Motive Power Has Far-Reaching Effects

The choice of motive power is of extreme importance because the characteristics of the power affect the earnings more than any other single factor and determine the efficiency of operation usually throughout the life of the engine. The problem of introducing new locomotives is similar to the problem of reducing grades and should be studied as thoroughly. The interrelation between the various factors affected affords large opportunities for savings and also for losses. No executive should be satisfied with a superficial analysis of the probable effect of a new type of power on operating costs. This is one of the problems of operation that has often been studied in a general way, but has seldom been analyzed quantitatively. The writer has made an attempt to develop a general method of determining the savings that might be expected from the use of high capacity locomotives, but at every step was so hampered by lack of accurate information that the conclusion was finally reached that there is no method of solving the problem without extensive research. Many investigations have been held up during the past few years, and the rapid changes in prices have made earlier data inapplicable. It would seem, therefore, that there is a large field for research in the economic problems of operation when normal conditions are restored.

A Shortcoming of Operating Statistics

The operating statistics as compiled at present are valuable for the analysis of existing conditions, but they furnish little information as to what would happen under other conditions. Thus the predetermination of operating results, which is most important from the standpoint of improved operation, is largely dependent upon the researches of the individual roads and of engineering organizations. Vast numbers of unrelated figures are compiled, but they are of little benefit in the solution of the general problem. What is needed is not merely a statement of the expenses under fixed conditions, but the rate of change of expenses under certain varying conditions, such as train load and speed. If such data were available, the analysis of operating results could be made more truly a diagnosis, rather than a mere post mortem. The investigation referred to above brought out numerous aspects of the economics of operation that apparently merit attention and a few comments on these points may be pertinent.

Many Factors Affect the Economic Value of the Locomotive

Most of the available reports on the economic value of large locomotives consider comparatively few of the items affected. The comparative costs of wages of train crews, of fuel and water and of repairs to locomotives are often the only items considered. In some few cases the comparative mileage and fixed charges on the investment in motive power have been computed. This is not sufficient to determine conclusively the relative merits of various types of power. The locomotive has a direct or indirect influence on many items of expense in the maintenance of way, maintenance of equipment and transportation accounts. The real problem in determining the value of a locomotive is to find the effect that its operation will have on the sum total of these accounts. The complexity of the problem has apparently often deterred railroads from giving it detailed consideration. However, it is a matter that goes to the very heart of the problem of economical operation and the results of a thorough study should more than justify the labor involved.

It is the purpose of the following paragraphs to point out some aspects of the problem that apparently are deserving of attention. A search through the literature on this subject has failed to disclose fundamental data on these questions that is applicable to present conditions.

The Effect of Motive Power on Maintenance of Way Expenses

Some roads have reached adverse decisions on the adoption of 2-10-2 type locomotives on the ground that the increased cost of roadway maintenance resulting from their use would more than offset the savings in wages. This opinion does not seem to be generally held, but as one of the arguments against heavy locomotives, it deserves recognition. Maintenance of way expenses make up about 17 per cent of the total operating expenses, but the greater part of the expenditures are independent of the character of the power. Much of the work of track maintenance is made necessary by the action of the elements, or by the necessity of maintaining the permanent way in suitable condition for fast passenger traffic. The expenditures which are most directly affected by heavy locomotives with long, rigid wheel base are rail, ties and track laying and surfacing.

There is little or no information available as to the comparative effect of four and five pairs of coupled wheels on rail wear and the other accounts affected. The more rapid wear of tires indicates that the effect on the rail is appre-

*A paper presented at the Railroad session of the Spring meeting of the American Society of Mechanical Engineers, Congress Hotel, Chicago, May 26.

ciable and the tendency to straighten out the track, no doubt, increases the cost of maintaining it in line. The actual effect will vary according to the wheel base, the curvature of the road and whether the locomotive has one or more pairs of drivers equipped with lateral motion devices.

The sum of the maintenance of way expenses which may be increased by heavy motive power is about 10 per cent of the total operating expenses and if the effect is to increase these items considerably, the saving will be difficult to make up in other accounts. However, if the wear and tear on the track is merely proportional to the weight of the engine, as is sometimes assumed, light and heavy engines would be on a par as regards these items. The difference of opinion on this question suggests the necessity for a careful investigation.

Maintenance of Equipment

In any study of locomotive operation the cost of equipment maintenance deserves careful attention. The percentage of the total operating expenses falling in this classification has shown a fairly consistent increase over a considerable period. Locomotive repairs and renewals, which in 1898 amounted to 5.9 per cent, in 1918 had increased to 11.7 per cent. So many factors may influence this ratio that no definite conclusions can be drawn, but it is significant nevertheless.

The principal difficulties in maintaining large locomotives are due to the short life of driving wheel tires, driving boxes and main pin bearings. With the proper facilities and proper construction the work of caring for these parts becomes merely a matter of routine running repairs, but where the lack or inadequacy of terminal facilities hampers repairs, the loss of service due to these minor items may become serious. In extreme cases the mileage per month may be reduced so much as to make the fixed charges per ton mile unreasonably high. It is hardly necessary to point out that this should not be charged against the locomotive itself.

While the foregoing remarks are confined to some of the more important items of roundhouse maintenance, they are equally applicable to the work of classified repairs. If the shops and shop machinery are not adequate for new power, repair charges will be high and the time out of service will be increased. The cost of these facilities should be considered when estimating the saving that may be effected by new power. The shop should be regarded as an accessory that is essential to the efficient utilization of the large investment in motive power. Too often the question is decided on the basis of the direct saving on repair operations, without considering the value of the locomotive days saved by proper facilities.

Wide differences of opinion appear to exist regarding the relative cost of maintenance and mileage of 2-10-2 type and Mallet locomotives. While the field for each is to a certain extent distinct, there are districts where either might be suitable and roads that have sufficient data to permit a fair comparison could perform a service by furnishing information that would clear up this question.

Long Trains May Increase Car Repair Costs Considerably

A very serious problem in connection with the use of locomotives of high capacity is the effect on the cost of repairs to freight cars. The total amount spent for repairs and renewals is nearly as great as the repairs and renewals to freight, passenger and switching locomotives combined. When the length of trains is increased beyond a certain point, break-in-twos, shifted loads and damage to the cars in general may increase at a rapid rate. It is not inconceivable that the expense resulting from hidden damage may nullify savings in other items. Local conditions determine whether or not this is an important factor. The effect of increasing the length of the train would be but slight where short heavy trains of steel cars are hauled. It may be serious where the road cannot control the character of equipment in the trains, where the car load is light, the train long and the lading is subject to damage, or of such a nature that it may shift and damage the car. It is significant to note that the study of the operation of Consolidation and Mikado locomotives made by N. D. Ballantine showed the time delayed due to car failures was more than twice as great with the Mikado engine, which had a tractive effort of 57,000 lb., than with the Consolidation of 39,000 lb. tractive effort. No record is available of the cost of repairing the cars involved in these failures nor the defects noted at terminals that were chargeable to unavoidable shocks incidental to the operation of the longer train.

A study of car failures in long trains may demonstrate that the trouble is largely due to equipment with weak underframes. The greater portion of the damage is done to the draft gear and sills, and it is doubtful whether sills meeting the recommendations of the American Railway Association would fail except under the most extreme stresses set up by surging in trains. If wooden underframes are a serious hindrance to the operation of long trains, the remedy can be applied with little difficulty. While the reinforcement of the remaining cars of this type still in service would require fairly heavy expenditures, it would no doubt be justified by the saving in repair costs and the improved operation that would result.

Transportation Expenses

The character of the motive power has a decided influence on the expenses falling under this head. Directly or indirectly, the locomotive affects items in the transportation expenses which amount to about 35 per cent of the total operating expenses. However, some of the accounts seem to be affected only slightly and the importance of locomotives, which are merely capable of delivering high tractive effort at low speed in reducing transportation expenses, has, no doubt, often been overestimated.

Two of the important items which are reduced almost proportionately as the tractive effort increases are wages of train enginemen and trainmen. The economies in these expenses are considerable and they can be predetermined with a fair degree of accuracy. Probably for this reason they have assumed undue prominence. In the year 1918 the wages of train employees amounted to 10.5 per cent of all operating expenses. The fuel bill for road engines was practically as much. The cost of locomotive repairs was even greater and freight car repairs only slightly less.

Relative Importance of Fuel and Wages of Train Crew

Some of the costly measures necessary to obtain slight increases in the train load can probably never be justified on the basis of the savings in the wages of train crews and some of the related savings are problematical. Railroad officers when considering means of promoting economy might well keep in mind this thought: The gross saving due to a given percentage reduction of the mileage of train enginemen and trainmen under average conditions is equalled by the saving due to a like reduction in the consumption of fuel.

Passing to the consideration of the relative fuel consumption of heavy locomotives, each increase in size results in slightly better fuel performance, provided that similar care is used in the design. The essential features of an efficient boiler are large grate area, ample firebox volume and tubes of suitable length to prevent excessive losses in the waste gases. All these can be obtained in the 2-10-2 type or other heavy locomotives. The large cylinders used with such power are also advantageous because the smaller ratio of the area to the volume reduces the heat loss in the cylinders. Within the range of normal operation, however, the difference in the fuel consumption per unit of work with a well-designed locomotive of the 2-10-2 type and the Mikado type, for example, is probably negligible. The remarkable fuel performance credited to some designs of Mallet compound locomotives suggests the advisability of establishing in as conclusive a

manner as possible the comparative results of this type of compound and typical large simple engines.

Some Items of Expense That Have Been Given Little Attention

The expenses directly chargeable to train service aside from fuel and wages, include lubricants and locomotive and train supplies. These items are of less importance than those previously mentioned and, in general, the charges per ton mile decrease as the tractive power increases.

The expense of yard operation is seldom considered as being influenced by the character of the road engines. In hump yards the cost of switching is probably independent of the length of the train. However, in drilling yards the necessity of hauling long cuts of cars reduces the speed of switching and increases the fuel used. While the net result is largely dependent on local conditions, this factor is of some importance and should not be passed over lightly in analyzing problems of operation with heavy power.

Enginehouse expenses likewise are affected by the character of the power to an extent depending on local conditions. The reduction in the number of units handled will cause a slight decrease in the cost per ton mile unless the new equipment requires additional facilities.

While the major items of operating expenses which enter into the problem of large locomotives have been discussed above, it is pertinent to enumerate several miscellaneous items which are affected to some degree. These include accounts affected by collisions and derailments, loss and damage, damage to live stock, clearing wrecks and injuries to persons. The effect of car failures on loss and damage has already been mentioned. Insofar as these expenses are due to collisions and derailments, they are increased by an increase in train density, rather than by an increase in the length of the train and would therefore be reduced by the use of locomotives of high capacity.

Fixed Charges

The only fixed charges on road and equipment which appear in the operating expenses are the depreciation charges on certain parts of the plant. While the separation of interest charges from labor and material may be desirable in the general balance sheet, the analysis of the advantages of various facilities is best made by considering the net amount that can be earned above the prevailing rate of interest.

The fixed charges on the motive power seldom exceed three to four per cent of the operating expenses. The difference between the fixed charges on a thoroughly efficient modern engine and a crude design that might be bought to make an insufficient appropriation cover a given number of locomotive is negligible. However, the difference in the earning power of these two types is quite appreciable and serves to show what large returns can be derived from the additional capital expended for refinements and accessories that give increased capacity and efficiency.

Reference has already been made to the advisability of considering the capital expenditure required for related facilities when deciding on the type of power. At first thought it might seem that the additional investment for terminals, shops and shop machinery would add greatly to the capital expenditure and the fixed charges. Under ordinary conditions the cost of roundhouse space required properly to house a locomotive is a comparatively small proportion of the cost of the power. The cost of the shop buildings and machinery is even less important when the added efficiency and decreased cost of repair operations is considered.

Sometimes the introduction of heavy locomotives necessitates strengthening or replacing bridges or laying heavier rail over certain sections. The expenditures involved are often quite large, but the relatively long life of these structures decreases the fixed charges and the additional cost per ton mile becomes comparatively small and is seldom an important factor in determining the most economical equipment. When new rail must be laid the additional expenditure is a more serious item and the charge would probably not be justified except on a line with relatively dense traffic.

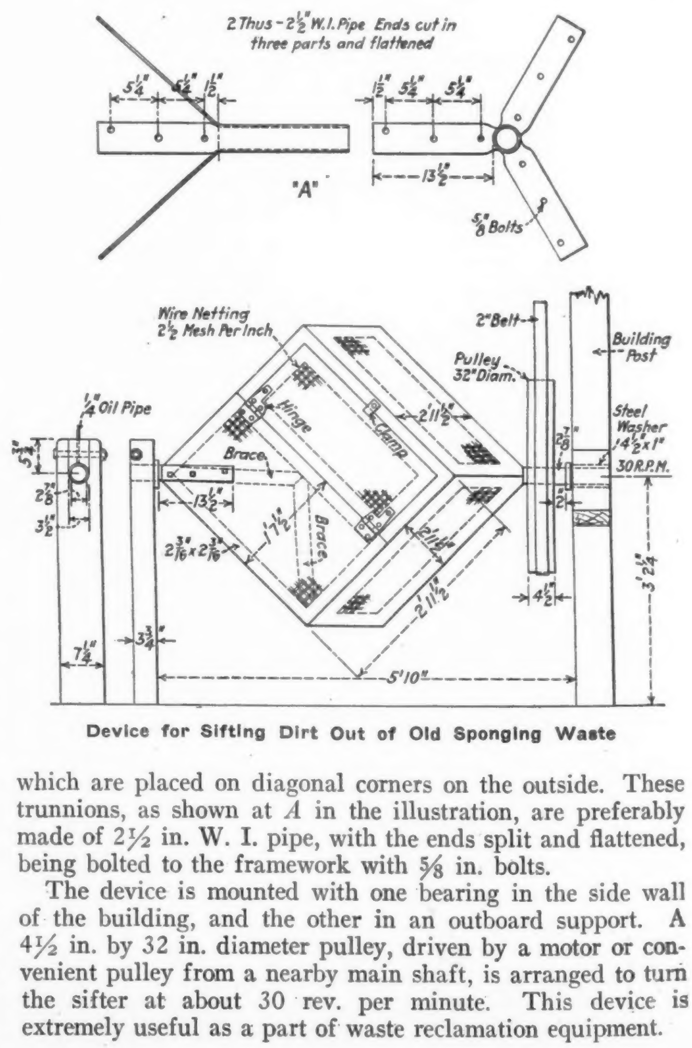
The preceding discussion pointing out the more important considerations involved in a study of the economic value of various types of motive power demonstrates the complexity of the problem. Probably no absolutely correct analysis is possible; surely, it is not practicable. The question is of extreme importance because the possibilities of economical operation are circumscribed by the motive power. For that reason the choice of the locomotive should be made with extreme care. The final decision should be based on a definite knowledge of the economies that can be realized, not on unsupported opinion. Engineering methods are essential in working out the solution and the study of the problem offers a field for constructive co-operative work by the members of the engineering societies.

Sifter for Renovating Old Sponging Waste

BY NORMAN MacCLEOD

In the reclamation of dirty sponging waste the device illustrated can be used effectively for sifting out dirt, sand, etc. The sifter consists of a wooden framework, made of 2 3/16 in. material, 2 ft. 11½ in. on each side. The sides are covered with smoke box netting, 2½ meshes to the inch, one side being provided with a hinged door for inserting and removing the waste. A small clamp, when swiveled in place, prevents the door from opening.

To the whole sifter are attached trunnions or bearings



Device for Sifting Dirt Out of Old Sponging Waste

which are placed on diagonal corners on the outside. These trunnions, as shown at *A* in the illustration, are preferably made of 2½ in. W. I. pipe, with the ends split and flattened, being bolted to the framework with ⅝ in. bolts.

The device is mounted with one bearing in the side wall of the building, and the other in an outboard support. A 4½ in. by 32 in. diameter pulley, driven by a motor or convenient pulley from a nearby main shaft, is arranged to turn the sifter at about 30 rev. per minute. This device is extremely useful as a part of waste reclamation equipment.

Car Shops Are Carefully Planned in Advance; Why Not Schedule Car Repair Work?

Scheduling Car Repairs Increases Shop Output

Outline of a Schedule Applicable to Passenger or Freight Car Repair Work in Large or Small Shops

By E. T. SPIDY*

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THE reason passenger and freight car repair schedules have received so little attention in the past is rather hard to understand. It may be because a large percentage of rolling stock superintendents are motive power men, having a more intimate knowledge of the details of locomotive repair work. In any case, scheduling locomotive repairs is now a recognized, economical method of keeping operations and parts moving, with the result that locomotives are held "out of service for repairs" a minimum length of time. For the past ten years, at least, it may be said that most large back shops have had a schedule or routing system of some kind in use, which definitely set up a plan whereby equipment was to be delivered repaired in 9, 12, 18 or 25 days, if necessary, according to the amount of work to be done. In every case, a definite delivery date was established and each day's work planned so as to complete the whole on the specified or scheduled date.

There is no logical reason why passenger and freight equipment cannot be scheduled so as to produce more output for these departments, as has been accomplished for the locomotive department. The same principles apply. Each shop, to have a successful schedule, must get a clear idea of what the objective is and how it is to be attained, taking into account the condition peculiar to each shop. The first thing a car man will say when the schedule is mentioned is "That's all right in the locomotive side where locomotives only are handled, but over here, we have twenty different kinds of cars, baggage, mail, day coaches, sleepers and so on, and we never know what must be done to them until they are brought in." In reality locomotive department men do not know exactly what must be done to engines before they are stripped, but depend upon careful inspections to determine the class of repairs needed. It is not the *amount of work* to be done that counts in determination of output; it is the time required to perform the *longest job.*

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Description of Schedule for Steel Diner

The first step in building up of a passenger car schedule, for example, is to plan or lay out the work to be completed each day. Assume that a schedule is to be made out for a steel dining car, shown by examination to be in pretty bad shape with considerable carpenter work inside and paint in bad condition, needing complete removal. This means that all trimmings will have to be taken out and done over and everything else given general repairs. In proceeding to make up the schedule let us assume the following conversation with the general foreman (G. F.) and paint shop foreman (P. F.):

"What is the longest job on this car?"

P. F. "Painting operations of course."

"Inside or outside of car?"

P. F. "Outside, in this case; sometimes, however, the inside is the biggest job."

"Yes, but does the inside painting govern the length of time the car is in the shop?"

P. F. "Not usually, because when the outside is finished, the car can be pulled out of the shop and the inside finished there if necessary."

"All right. Now, since the painters have the longest set of operations, let us get them on the job as quickly as possible, and see if we cannot do all the other work inside the time required by the painters to complete their work. What do you do first?"

G. F. "Remove all metal trimmings, seats and sashes, and send them to their respective departments to be repaired. Then the car is washed."

"Could not this stripping be done before the car is taken into the shop? And how long should it take?"

G. F. "Yes, no trouble about that, especially in good weather. In any case, including the washing, one day would cover this work."

"In preparing the standard schedule sheet (Fig. 1) the

car is stripped complete and washed the first day. Also on the first day in the shop, the electricians must be on the job and strip their part, all other material being removed from the inside and distributed to the proper departments for repairs. The washing department must wash the car so as to be ready for the next day's operations. What part of the work is done next?"

G. F. "The car is moved to the track where it will stay until turned out. Carpenters go on the job. The car is jacked up, trucks removed and the car lowered on shop trucks or posts."

"Let us put all that down for Day 2, but there is no reason why painters cannot also start to remove paint, is there?"

P. F. "I guess not. Put them down to start, and they will finish the next day."

"When will the carpenters complete their work so that the painters can go ahead?"

G. F. "That will depend upon conditions, but I should say they would want two days on the outside and four on the inside."

"Let us put it down at that and you can increase the gang if necessary, to get it done on time until they get into the stride of the thing. Notice that the carpenters start outside work on Day 2, finishing on Day 4 and inside carpenter work is started on Day 2, being finished on Day 6. This means that painters on the outside start on Day 2 also, but painters on the inside cannot do much until the carpenters are clear. They may start in places, but we will not schedule them started because, for a good job, the carpenters must be out of the way. Now let us list up paint operations and the time required."

G. F. "We do not have a regular course for all cars, although generally we do go through a process which is modified according to the output desired."

"Too bad, but not unusual by any means. It follows obviously that without uniformity of treatment, uniformity of results cannot be expected, and so nobody knows whether good or bad service is the result of poor materials, methods or work. The American Railway Association Committee on Equipment Painting issued a report in 1920 giving a recommended classification for painting car department equipment, which we might adopt in this discussion as a base on which to work. Let us use it for a start, and build up a schedule, changing it if necessary. The car evidently comes under the first paint schedule given, Class A repairs being the heaviest repairs shown. It is evident that Day 1 for the painters is Day 2 in the shop on our schedule. Operations on the schedule follow."

Day 2. Carpenters start on outside and inside.
Trucks removed and delivered to truck repairers.
Painters start to remove old paint and varnish.
Day 3. Painters finish removing paint on outside.
Day 4. Carpenters on outside finish.
Painters put on priming coat.
Day 5. Inside carpenters still on inside work.
No paint operations, as primer requires 48 hours to dry.
Day 6. Inside carpenters finish.
Apply prime coat on inside of car.
Apply first coat of surfacer on outside.
Day 7. No paint operations on inside, account 48 hours being required for primer to dry.
Day 8. Outside—second coat of surfacer.
Inside—first coat of surfacer.
Day 9. Outside—third coat of surfacer.
Inside—putty and knife pitted surfaces.
Day 10. Outside—fourth coat of surfacer.
Inside—second coat of surfacer.
Day 11. Outside—rub with rubbing brick and water.
Inside—third coat of surfacer.
Day 12. Outside—sand and touch up with primer.
Inside—Rub with rubbing brick and water.
Day 13. Outside—first coat of color.
Inside—sand and touch up with primer.
Day 14. Outside—second coat of color.
Inside—first coat of color.
Day 15. Outside—letter and apply first coat of varnish.
Inside—second coat of color.
Day 16. Dry day, no operation on outside.
Inside—grain.
Day 17. Outside—second coat of varnish.
Inside—varnish (first coat).
Day 18. Outside—dry day, painters on outside finished.
Inside—stripe, number and necessary notices applied.

Before proceeding, we note here that since the outside work is all finished, as far as the painters are concerned, there is no reason, if shop track space is a limiting factor in getting output, why the car could not be trucked with the repaired trucks on the eighteenth day. Day 18, therefore, constitutes the date for the truck repair gang to finish and deliver ready for the car, its own trucks. If necessary, the car can be finished outside of the shop from Day 18. Proceeding with the painters inside the car:

Day 19. Varnish inside of car (second coat).
Day 20. No operation, allowing varnish to dry.
Day 21. Rub varnish to finish required.

With the painters finished, the work of other departments should be considered, to be sure that they will deliver parts in sufficient time to apply completely without holding up the

STANDARD 22 DAY

SCHEDULE SHEET

CAR No. 2291 Diner
REPAIR A Class 22 Days
SCHEDULE 20 Days in Shop 2 days outside
DATE IN April 25th 21.

Schedule Day	Sch. Date	Carpenters Outside	Carpenters Inside	Outside Painters	Inside Painters	Sash Dept.	Electricians	Plumbers and Tinsmiths	Upholsterers	Trucks
1 IN	4/25	Strip		Wash		Delivered	Remove	Strip	Strip	
2	26	Start	Start	Remove Paint	Remove Paint		& Deliver			Remove
3	27			" " finish	" " finish					
4	28	finish		prime		prime				
5	29			dry		dry				
6	30		finish	1st surfacer	prime	1st surfacer				
7	5/2			putty & knife	dry	putty & knife				
8	3			2nd surfacer	1st surfacer	2nd surfacer				
9	4			3rd "	putty & knife	sand				
10	5			4th "	2nd surfacer	1st Color				
11	6			Rub - brick	3rd "	2nd "				
12	7			sand	Brick Rub	1st Varnish				
13	9			1st Coat Color	sand	dry				
14	10			2nd " "	1st Coat Color	2nd Varnish				
15	11			Letter & 1st Var.	2nd " "	dry				
16	12			dry	grain	Deliver to Car				
17	13			2nd Varnish	1st Varnish					
18	14			dry	Stripe & Number		Switchboard O.K.			apply Trucks
19	16				2nd Varnish		Lighting fix. O.K.			
20	17		start trim		dry		Test Batt.	Heating O.K.	deliver	
21	18		fin. trim		Rub		finish	Plumbing finish	finish	
22 OUT	19		clean							
23										
24										
25										
26										
27										
28										
29										
30										
31										

REMARKS:

Fig. 1—Example of Standard Schedule Sheet for Dining Car

car. Car trimmers cannot start until inside painters have finished varnishing operations at least, and the work takes possibly two days. So we add to the list:

Day 19. Trucks applied.
Day 20. Car trimmings finished and delivered to car, and trimming started.
Day 21. Finish trimming car.
Day 22. Clean, inspect and O. K. for service.

The longest operations on the car are now covered. They might be called the controlling operations of the schedule since they control the length of the "out of service" period. In order to make this schedule complete, it is necessary to set a starting day and a finishing day for all sub-departments that handle any part of the car. Thus, electricians must finish all testing the same day the trimming is finished; namely, Day 21. Plumbers, steamfitters, upholsterers, etc., must also finish on Day 21. For each of these departments, it may be advisable to detail each day's work so that, even if they have only six days' work to do, and a period of twelve days in which to do it, the minimum number of men required may be determined. In larger shops, there is a sash department to which all sash are delivered when a car is stripped. This department usually gives sash practically as long a schedule of operations as the outside of the car gets. All departments are capable of a detailed analysis as outlined, but it is not always advisable to go into such details for

the sub-departments, depending entirely on the amount of work handled per month.

The net result of the foregoing is to develop what may be called a twenty-two day schedule for this class of car and repair. What logical reason is there why a similar schedule for each class of repairs cannot be developed? Heavy, medium and light repairs, called Class A, B and C according to A.R.A. recommendations, are decided on. Equipment is divided into as few "class of car" divisions as practicable. All passenger equipment, for example, coming in one general class which may be subdivided into ordinary day coaches, sleepers, diners and other high grade equipment. Next baggage and mail cars may form a class and so on according to the requirements of a particular road.

Operation of the Schedule

Having made this schedule, how is it to be handled? First of all, using a calendar, mark opposite Day 1 on the schedule the date that corresponds to the day the car is booked in. Then follow down the schedule, inserting a date opposite each day, Sundays and holidays being omitted, but not Saturdays. Even if only half a day is worked on Saturday, try and arrange for a coat of paint to be applied, because Sunday then becomes a schedule day, if it can be utilized for drying.

Next take a large sheet of section paper about 24 in. square and makes a series of about 30 vertical columns as shown in Fig. 2. At the head of each column put in the dates of the month, leaving out dates corresponding to Sundays and holidays. On the left side of the sheet, list up all the operations which have developed and leave room for others that may come up. Now take the schedule list with the dates entered and, starting at the top, find the corresponding operation on the large sheet, entering the car number on the same horizontal line under the required date. Follow this process by putting this same car number in the intersecting square of each operation and date it is scheduled to be performed and you have a complete "date schedule." It is advisable to mount the date schedule on a board.

As each car comes into the yard, an inspection of the car and painting is made to determine the class of repairs. A detailed schedule is then prepared covering all operations, this being done by the man placed in charge of all scheduling.

PASSENGER DEPARTMENT SCHEDULE

April 4.

DAILY WORK SHEET

The following operations are due to be completed tomorrow, April 5:

Car No.	Outside	Inside
334	Remove paint	Remove paint
2123	Prime	
2099	First surfacer	Prime
654	Putty and knife	Dry
743	Scrape	Scrape
1435	Dry	Second varnish
763	Third surfacer	Putty
871	Letter	First varnish
1235	First color	Sand
1743	First varnish	Second color
884	Sand	Third surfacer
2377	Second varnish	First varnish
671	Dry	Rub
943	Rub with brick	Third surfacer
1066	First varnish	Dry
1132	Dry	Grain

Fig. 3—Work Sheets Are Taken Daily from the Date Schedule and Sent to Departments Concerned

Each detail sheet is entered on the date schedule as soon as made out, and when all cars in the shop are covered, each column represents the operations due to be performed on the date at the top of the column.

Now comes a most important point. This chart, like all charts, is of little value unless used. Each afternoon, the schedule man makes a list of all work due to be done tomorrow. He gets this list typed out and into the hands of all foremen and assistant foremen concerned before they quit for the day. In the afternoon, he goes to each car and checks up to see if the operations scheduled are done or not; if not, he ascertains *why* (again an important point) and marks his copy with the reason. On returning to the office, he makes a list of all failures to do the work scheduled, indicating the reasons, and hands this list to the general foreman. The general foreman then goes to all departments knowing where they were delayed the previous day and lending his influence

DATE SCHEDULE

NAME OF OPERATIONS		APRIL						MAY																							
		25	26	27	28	29	30	2	3	4	5	6	7	9	10	11	12	13	14	16	17	18	19	20	21	23	24	25	26	27	28
Car in Shop		2291																													
Trimming removed		2291																													
Car Washed		2291																													
Carpenters start	Outside		2291																												
" "	Inside		2291																												
Trucks removed			2291																												
Painters start to remove paint	Out. & In.		2291																												
Painters fin. remove paint	Outside			2291																											
Carpenters finish	Outside				2291																										
Painters apply priming coat	Outside				2291																										
Drying day for primer	Outside					2291																									
Carpenters finish	Inside						2291																								
Painters apply prime coat	Inside						2291																								
" " 1st coat surfacer	Outside						2291																								
Drying day on inside								2291																							
Second coat surfacer	Outside								2291																						
First " "	Inside								2291																						
Third " "	Outside									2291																					
Putty and knife	Inside									2291																					
Fourth coat surfacer	Outside										2291																				
Second " "	Inside										2291																				
Rub with brick and water	Outside											2291																			
Third coat surfacer	Inside											2291																			
Sand and touch up	Outside												2291																		
Rub with brick and water	Inside												2291																		
First Coat of color	Outside													2291																	
Sand and touch up	Inside													2291																	
Second coat of color	Outside														2291																
First " "	Inside														2291																
Letter and apply 1st coat varnish	Outside															2291															
Second coat color	Inside															2291															
Drying day for varnish	Outside																2291														
Grain	Inside																2291														
Second coat varnish	Outside																	2291													
First coat varnish	Inside																	2291													
Drying day for varnish	Outside																		2291												
Apply trucks (if to finish outside)																			2291												
Stripe and number	Inside																		2291												
Second coat varnish	Inside																			2291											
Apply trucks and level car	(if in shop)																			2291											
Drying day for varnish	Inside																				2291										
Trimmings, start to apply																					2291										
Rub down varnish	Inside																					2291									
Finish trim car																						2291									
Plumbers finish																						2291									
Steamfitters finish																						2291									
Upholsterers finish																						2291									
Electricians test and finish																						2291									
Clean and O.K. for service																							2291								

Fig. 2—Schedule for a Single Car Showing Dates Detailed Operations Are Due

and authority to prevent a recurrence of delays in the future.

It soon works out that when an assistant sees he is going to fail, he takes up the matter himself before the general foreman gets after him about it and very often the delay is prevented altogether. If average outputs before and after car shop schedules are in operation are checked, nobody will have an argument against the schedule. The great probability is that under schedule planning, output will increase 30 per cent and more and the railroad will have a definite measure of the service given by the materials used.

The whole idea is to have a definite plan and see that it is lived up to. The car schedule, illustrated, was for the heaviest kind of repair on the class of car that gets the best work done on it; therefore, it is probably the longest schedule likely to be used. The example taken was merely to show how to build up schedules, not to say this is a correct or good one for any particular shop.

PASSENGER DEPARTMENT SCHEDULE

April 4.

DAILY WORK SHEET

The following operations are scheduled to be done tomorrow, April 5:

Department	Car No.	Operation
Carpenters	334	Start outside
	2123	Finish outside
	2099	Finish inside
	654	Finish inside. Late one day
	743	Start outside
Upholsterers	2541	Deliver to car
	2633	Deliver to car
	4122	Deliver to car
Steamfitters	2541	Finish heating
	2740	Finish heating
Trimmers	2541	Finish trim
	1435	Start trim
Electricians	2541	Batteries test and lighting O. K.
	1435	Switchboard O. K.
Brass Dept	1734	Deliver all trimmings
	1438	Deliver all trimmings

Fig. 4—Example of Daily Work Sheet

Figuring Monthly Output

A word or two regarding figuring output per month by schedule methods. If a shop has 60 tracks or car spaces under the roof and the number of schedule or working days in a month is 25, the product of these two factors is 1,500 track days. Now suppose, on an average, a heavy repair takes 20 days; a medium repair takes 12 days, and a light repair takes 8 days. We can readily see that including all schedule days under the shop roof an output of 75 heavy repairs, or 125 medium repairs, or 185 light repairs is available. Also if it is decided to finish cars outside of the shop, that is take them from under the shop roof as soon as outside painting operations are finished, the shop capacity is automatically increased by deducting at least two days per car under the shop roof. This means that the output can be increased to 83, 150 and 250 cars per month for heavy, medium and light repairs respectively, an average increase of over 25 per cent by a decrease of only two days per car. Is it important?

PASSENGER DEPARTMENT SCHEDULE

WEEKLY PROGRESS SHEET

To all Departments:

The following cars are due for service next week on dates shown:

April 4—Monday	1322	April 7—Thursday	975
	763		1747
April 5—Tuesday	1421		717
	1530	April 8—Friday	1414
	621		1175
April 6—Wednesday	1483		918
	1377	April 9—Saturday	1749
			606

Fig. 5—Weekly Progress Sheet for the General Information of All Supervisors

No road gets all one kind of repairs, so by using the total track days available as a base and multiplying and adding cars of each class of repairs (heavy, medium and light) as they may be available, keeping the sum equal to 1,500, the maximum output under definite methods is obtained. Suppose an output of 130 cars a month in this particular shop is desired.

50 heavy repairs at 18 days each	=	900 track days.
30 medium repairs at 10 days each	=	300 track days.
50 light repairs at 6 days each	=	300 track days.
Total available	=	1,500 track days.

Any other combination that adds up to 1,500 track days on 20, 12 and 8 day schedules, figuring to finish the last two days' work outside, can be used.

In conclusion, it may be said that the foregoing outlined schedule is applicable to small shops as well as large ones. The main difficulty in applying it is due to the aversion of many practical railroad men, brought about unfortunately by an influx some years ago of so-called efficiency engineers without practical knowledge of railroad conditions. The schedule gives a clear definition of duties and definite instructions as to the order of work, resulting in better service at lower costs. In shops where material is scheduled from one department to the other foremen can stay in their own departments, where they are needed all the time. This is one of the biggest arguments for scheduling, and alone is worth more than can be estimated. The details of forms and methods will develop themselves in each shop and constitute no valid objection to car shop scheduling systems.

PASSENGER DEPARTMENT SCHEDULE

LATE LIST APRIL 7

The following delays were reported yesterday:

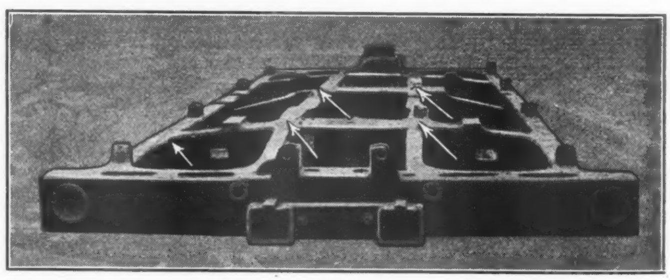
Car No.	Department.	Reason for delay
1717	Paint	Men out
1643	Paint	Carpenters not finished
2321	Carpenter	Waiting material from mill.
763	Electrician	Battery trouble
1431 (2 days)	Truck	Waiting for tires

Fig. 6—Summary of the Delays Occurring in One Day, Material Delays Also Being Recorded on This Form

Reclamation of a Badly Distorted Tender Frame

A locomotive recently came to a back shop for repairs with the tender frame badly damaged and distorted by a side blow. In view of the serious nature of the damage it was at first thought that the frame would have to be scrapped but it was finally reclaimed by straightening and welding.

Before proceeding with the straightening, a special straight lever was made by using two bars of 2¼ in. by 9 in. by 18 ft. follower plate steel. A space of 3 in. was left between the bars for eyebolts and clamps, an arrangement which gave a powerful leverage. It was necessary to heat the tender frame in eight places at one time in order to straighten each end of the frame.



Tender Frame Straightened and Thermit Welded at Five Places

Oil and charcoal were used as fuel in obtaining the expansion. The center I-sections that were broken were welded in five places with Thermit using about 65 lb. for each weld. The location of these welds are plainly shown in the illustration by the arrows.

The Problem of Machine Tool Selection

Ignorance of Cost of Capital Investment and of Operating Costs Leads to Unsound Decisions

BY R. S. MENNIE

THE usual procedure for the purchase of shop machinery, after the annual budget has been approved, is somewhat similar on the various leading railroads. The first step is to prepare a list of machines, the extent of which will depend entirely upon funds available or the amount appropriated under the budget. Requisitions are then originated either in the office of the chief mechanical officer or at the shops where the machines are finally to be located. After requisitions have been prepared, including more or less complete specifications, they are forwarded to the purchasing agent who obtains bids from various manufacturers or jobbers and submits these bids with the manufacturer's standard specifications to the chief mechanical officer for final recommendations.

In view of present conditions as regards the urgent necessity for strict economy, it may be of interest to discuss the consecutive steps in the purchase of this equipment. First, the preparation of the initial machine tool list for the annual budget. This is usually done by master mechanics or some mechanical department officer in close touch with the shops. Frequently, the local shop authorities make a list of their machine tool requirements and forward this to the general office, where the budget recommendations are eventually compiled. In any event the final list of machinery usually expresses as far as available funds will permit, the ideas of the shop officers as to their machine tool necessities.

Capital Charges Often Disregarded

It should be remembered, however, that under existing methods of shop accounting, these ideas are not regulated or controlled by any thoughts as to the possibility of incurring heavy additional capital charges or similar considerations which usually govern the management of manufacturing establishments in like circumstances. There is always the possible tendency to insist upon new machinery and the replacement of old tools without the formality of any careful analysis to determine whether or not a new machine is really necessary or whether the expense is justified by the possible savings.

Compare the attitude of a railroad master mechanic with that of the manager of any successful manufacturing plant. The master mechanic endeavors to get rid of all old machinery and to substitute modern, up-to-date equipment. He is well aware that with high grade tools in good condition, locomotive repair parts can be rapidly handled through the shop and there is an excellent possibility that output will increase to the assumed benefit of the company and his own certain credit. He has no incentive to go very deeply into the economics of the matter nor to consider that the additional production obtained through the purchase of new machinery may not necessarily mean a net profit to the railroad.

On the other hand, the manager of an industrial concern must analyze the situation with great care, because he is constantly confronted with the fact that the purchase of additional machinery means an increase in fixed charges. He knows that if this additional capital charge is not met by increased savings, by a reduction in the number of employees, or absorbed in some way, the cost accounting system will shortly indicate a loss instead of the anticipated profit.

Unfortunately the cost accounting methods used in the average American railroad shop do not reflect the true situation as regards the ultimate expense to manufacture and apply locomotive or car repair parts. It is, therefore, only to be expected that advantage will be taken of this fact to secure credit for increased shop output regardless of heavy losses in depreciation, interest, maintenance, etc., that are never accurately set forth.

Specifications for Machine Tools

The preparation of machinery, specifications and shop requisitions is a second step in the purchasing procedure. Assuming that the machine tool list has been properly compiled after a careful study of the matter in all phases, it is then of equal importance that machines of proper size and design shall be specified.

For the ordinary railroad shop engaged in making general locomotive repairs, a few special tools such as wheel lathes, quartering machines, wheel presses, etc., are required. By far the greater number of machines, however, are standard equipment widely manufactured, such as boring mills, lathes, planers, shapers, drill presses, etc. It does not seem advisable for any railroad to attempt the preparation of complete specifications covering exact details of their machine tool requirements, as this results in high prices without com-

mensurate benefits. The plan usually adopted is to prepare a brief statement giving merely the essentials of the tool desired including kind of drive and necessary special attachments. This permits manufacturers to submit bids on their standard product and enables the railroads to obtain wide competition.

Size of Tools Needs Careful Study

In preparing requisitions for shop machinery it is important to keep in mind the various operations for which the tools will be used and in particular, if machines are to be located at some isolated point, to see that each tool has adequate capacity to handle the occasional big job which otherwise would have to be sent perhaps two or three hundred miles to some place having the required facilities. It is a matter of considerable annoyance and often quite costly to find, after installing an expensive new machine, that one-half inch greater swing or another foot added to the bed would have enabled the isolated shop to take care of the extended piston rod or some other exceptional part and avoid holding a badly needed locomotive out of service perhaps days or even weeks.

For the larger shops where a variety of lathes, planers, drill presses, etc., must be provided, there is a possibility that machines larger than really necessary will be specified. Long lathe beds, planer beds, etc., take up much valuable space. Exceptionally long work should, of course, be provided for, but when this is done the remaining machines ought to be specified in accordance with the work they are intended to perform. In some shops as many as six or eight 30-in. and 36-in. lathes each with 16-ft. beds may be observed. On the majority of these machines the work is such that about six feet of the bed is never used and serves principally as a handy receptacle for waste, surplus tools and miscellaneous litter.

Special Attachments

It is important in preparing requisitions or specifications for shop machinery to keep in mind the fact that it is often desirable to have machines equipped with special attachments or devices that will enable the handling of work never contemplated by the tool manufacturers. I have in mind one case where a 100-in. boring mill was equipped with a special fine feed attachment thereby enabling packing rings to be cut in emergencies when the smaller mills ordinarily used for this purpose were crowded with other work. No doubt very many similar instances can be called to mind where new machines have been altered or provided with special home-made appliances which might easily have been taken care of during manufacture and at much less expense if the specifications had been drawn sufficiently complete to include these items.

It is also advisable in preparing specifications for machinery to make some mention of the necessity for the thorough safeguarding of all dangerous moving parts. Most manufacturers of metal working machines include these guards as part of their standard design, but in the case of some wood-working machinery guards are extra and are not furnished unless definitely specified. Money can usually be saved if this equipment is provided by the builder and the guards are frequently of neater design than those applied by shopmen after the machines are installed.

Selection Should Be Based on Study of Details of Construction

When bids have been secured the next step, prior to placing orders, consists in selecting the most suitable equipment from the quotations received. This is usually done by a mechanical department officer or by an official committee. In any event, it is of vital importance that the recommendations made to the purchasing department covering the final choice of machine tools, shall be based upon a sound knowledge of value, unbiased by prejudice or the persuasive conversation of expert salesmen. Perhaps the greatest obstacle to overcome in judging machine tool values is prejudice on the part of sometimes thoroughly practical men. Prejudice in favor of a manufacturer's machine with which railroad men are familiar, often works to the serious disadvantage of some other manufacturer having a better tool the superior quality of which only becomes apparent after a study of its intimate construction. The average mechanical department officer has practically no time to study closely the construction of machine tools—he has many more serious problems to contend with—consequently his tendency is to be conservative. The result is often to favor the familiar machine, one that has proved satisfactory in the past, although it may not by any means be the best machine and may even be seriously deficient, if judged by modern standards.

In order to keep the shop machinery of a railroad with average traffic up to a reasonable standard of efficiency, the writer estimates that it is necessary to spend about $20,000 per year per 1,000 miles of line. Based on this estimate a 6,000 mile railroad should spend $120,000 per year on new shop machinery. This amount does not include maintenance or repairs, but merely replacements and additional equipment. Consequently, after a railroad system attains a size of more than about 2,500 miles, the annual sum expended for shop machinery begins to assume an importance well worthy of someone's time to make certain that there shall be no waste of company funds.

Avoid Unnecessary Refinement

In selecting railroad shop machinery from quotations and accompanying specifications, it is well to remember that in many cases an ordinary, moderate priced lathe, planer or other machine is the best possible choice. For example, at some outlying point at irregular intervals a planer or boring mill is badly needed. This machine will be used perhaps two or three times per day. In this case, the usual policy is to transfer an old machine from one of the larger shops, but if it is decided to install a new machine, a low priced tool of simple construction or a second-hand machine in good condition, should be selected.

Even for the important shops, if the work to be handled in each instance is given consideration, it will often be found that a machine of moderate price will meet requirements. Railroad machinists do not usually work with micrometers or with limit gages. The situation is very different from that in those manufacturing establishments where success is entirely dependent upon ability to produce rapidly interchangeable parts accurate to the 1/10,000 part of an inch. The best and most refined construction in machine tools is none too good for this purpose, whereas in a railroad shop, machines of this type are a questionable investment.

Machine tool dealers when requested to bid on railroad specifications usually quote on their high grade product with an alternative bid on some less well known tool of considerably lower price. Most of us have a natural tendency to favor the high priced article, especially if the necessary finances are available. It is well, however, to bear in mind that for railroad shop service the alternative and lower bid is frequently by far the better proposition.

I do not desire to convey the impression that machines of inferior or cheap construction should be considered. Tools of this character are very high priced and eventually prove to be the worst possible investment. The machines in mind are rigid, well built tools with adequate bearing surfaces, steel gears where necessary, good lubrication facilities and all essentials of a first class product. They have not perhaps that exact refinement and high accuracy best adapted for interchangeable manufacturing operations. Such operations, however, are of a precision entirely foreign to those usually performed in a railroad shop.

Success in the selection of suitable machinery for railroad service can only be attained by a constant study of shop operations and the exercise of sound judgment in providing adequate facilities to handle these operations with neither the wasteful expense involved in over-refined and elaborate equipment nor the even greater extravagance incurred by choosing cheap, poorly constructed tools.

Analyze Cost of Shop Operations

Some kind of a real cost accounting system, if a practical scheme could be devised for railroad shops, would undoubtedly be of great benefit in the economical selection of machine tools. No shop superintendent or master mechanic would then insist upon expensive shop equipment if he knew that from 20 to 25 per cent of each dollar invested in such equipment would be added annually to the cost of work done under his jurisdiction. He would at least have the incentive to analyze carefully the necessity for new machinery and to ponder seriously the advisability of such recommendations as a $6,000 motor-driven, geared head lathe when a three step cone belt-driven tool at $4,000 would meet requirements.

In the absence of such a system the best that can be done is to impress all concerned with the fact that unless a machine can be kept constantly busy producing a steady output, loss is incurred depending upon the length of time the tool is idle and the total amount of money invested. Therefore, when it is known that a machine must necessarily be idle a considerable portion of the time, it is wise to keep the investment at the lowest point possible by the use of an old machine or purchase of second-hand equipment. In any event, when a new tool is contemplated a careful statement should be made estimating as closely as possible the cost to handle each unit of production with the existing equipment. A similar statement should then be prepared to determine the cost with the new installation. If this work is done properly it will be possible to arrive at some definite idea as to the savings that may be expected when the proposed new installation is complete. In both estimates care should be taken to include capital charges both upon the old and new investments.

Analyses of this character are of the utmost value in determining whether or not it is wise to make expenditures for machinery and if prepared in a true businesslike manner they will be of great assistance in demonstrating to the management just how much can be saved and exactly to what extent new machinery is justified.

Improving a Shop by a Limited Expenditure

A Small Production Department Relieves the Machine Shop and Insures Maximum Output from New Tools

BY G. M. LAWRENCE

There is little chance for argument about the necessity for improved shop machinery. Now that the Labor Board has abolished the National Agreements and laid down a set of rules which give promise of paving the way for industrial peace through local conference and agreement, it is the hope of all shop supervisors that more consideration will be given the problem of shop equipment.

However natural it is to blame all our troubles on the war and the result of federal control, most shop men know that the present lack of efficiency is partly the result of neglect in keeping abreast of the times with needed improvements in the shop to properly maintain the ever changing locomotive. For many years, while inventive genius has enlarged and improved the locomotive from a 40 to 60-ton machine to the present magnificent power plant, the shop and terminal facilities for handling the locomotive on a large number of railroads have practically stood still, leaving the inventive mechanic to work out the problem of maintenance with equipment 40 years old. Of course some enlargement of terminals, turntables, coaling facilities, etc., has been made as a result of necessity and electric and oxy-acetylene welding and cutting have been introduced in most shops, but in too many shop the progress has stopped here. In no department is the neglect more apparent than in the machine shop.

Main Rod Brasses, Machined in Shop Order Lots of 30 Pairs

To correct these conditions at once would mean an entire new shop in a great many cases at a cost of several hundred thousand dollars and there are no such sums available at present nor are they likely to be for some time to come.

The machine problem at least can be partially solved, I believe, by the introduction of a production department. A modest beginning can be made by the purchase of six machines as follows: a 42 in. vertical turret lathe, a 6 ft. radial drill press, a 10 ft. planer, a 28 in. heavy duty shaper, a 24 in. slotter and a 3 in. turret lathe. This equipment can be purchased at a cost of not to exceed $30,000.

These machines should be installed in a room or building apart from the regular machine shop and under the supervision of a foreman responsible only to the general foreman. In the contract for these machines should be included the services of a demonstrator whose duty would be to instruct the workmen in producing maximum output from each unit. By the proper use of these machines it would be possible to finish all the cylinder heads, crossheads, driving and truck boxes, brasses and cellars, valve bushings, bull rings and packing rings, cylinder packing rings, piston heads, eccentrics and straps, air pump cylinder bushings, guides, shoes and wedges, rod straps, frame and pedestal braces, brake and spring rigging pins and bushings, cylinder head

and boiler studs and many other parts too numerous to mention in sufficient quantities to supply a shop output of 25 engines per month. All parts should be manufactured in quantities of not less than a day's output per machine at a time, wherever possible, as modern machines are designed primarily for production work and efficiency is lost by making frequent changes in setup. A record should be made of all operations in their relative sequence, giving tooling, etc., as well as the minimum time required for each operation as a guide to the workman and a measure of efficiency. All tools should be prepared in the tool room and only minor grinding to restore the cutting edge should be permitted at or near the machine to keep the machine producing as much of the time as possible.

When these machines have been in service a short time it will be possible to take many of the older machines out of service, a few at a time, for a much needed overhauling. A few of the very best mechanics should be assigned to this work and a thorough job done which will restore the efficiency of the machines and put them in condition to permit better workmanship.

The introduction of a cost accounting system into the shop would reveal many sources of economy and would result in a great many changes in practice. No merchant or manufacturer could be successful in business who did not know in detail the cost of his product for the reason that he would not know what to charge the consumer. The total cost of transportation is doubtless known, but who in the shop can truthfully state for instance whether it is more profitable to manufacture square-head bolts in the shop today than to purchase them in the open market or whether it is more profitable to file saws by hand or invest a few dollars and purchase an automatic machine that will file ten times more saws than a man and produce a vastly more serviceable tool as well? Cost accounting and production should go hand in hand in the railroad shop. Before a new tool is purchased it should be known absolutely that the investment is going to be profitable. Labor and material costs are constantly changing and therefore an operation which is profitable today may represent a loss tomorrow. With the present high cost of labor it would doubtless be more profitable to purchase a new machine here and there about the shop to do work now done by hand. For example, it is customary in most shops to flange all sheets used in boiler work by hand, by the use of a sledge and forming block and sometimes with the use of a flange clamp which for the heavier sheets requires heating. It is possible to purchase an air operated flanging machine which will handle all sheets up to one-half inch in thickness, cold and save many times the cost of the machine each year. There is practically no limit to the savings that would be revealed by a proper cost accounting system in the railroad shop.

Accumulating a Stock of Standard Piston Packing and Bull Rings

Cost accounting implies much and frightens the average shop man who pictures in his mind endless dry statistics compiled by a large staff of highly paid non-producers, all of whose wages go on the wrong side of the ledger. This is, of course, a wrong conception. There is no doubt in the writer's mind but that it would be profitable to have a complete inventory of any railroad shop compiled by an expert accountant setting forth original investment, and the cost of depreciation, overhead expense, supervision, etc., by departments with enough of the details of operation to determine whether the shop is a paying business. This, however, is not my idea in suggesting cost accounting at this time. As a beginning any well informed mechanic who has a taste for clerical work could make a study of one operation after another about the shop and make recommendations for improvements, suggest new machines or alterations in methods of procedure and back up his recommendations by figures together with catalogue references and prices in such a way as to enable the shop superintendent to handle the matter successfully with the head of the mechanical department. No doubt much of our lack of equipment is due to the fact that no proper information was ever given to the mechanical superintendent or general manager, or else it was given at the wrong time.

Fractures in Boiler Tubes*

After having run about 60,000 miles an engine of the Midland Railway came into the repair shops in the middle of 1919, the tube ends in the firebox being slightly burned and arrangements were made, as is the custom, to drive the tubes up from the smoke box end. At the first blow the end of the first large tube to be operated on fractured. Investigation showed that of the 21 large tubes, 8 had brittle ends, while 13 were fairly malleable.

The tubes were lap-welded, and it was obvious that the "steel tube strip" from which they were made was in both cases of poor quality. It will be appreciated that the use of this class of steel was entirely due to the war conditions prevailing. Microscopic examination showed that the impurities were largely concentrated in the boundaries between the crystals, and that the fractures were generally found to be intercrystalline.

Chemical analyses showed that tubes with brittle ends were unduly high in phosphorus, which was generally between 0.14 and 0.16 per cent, while tubes with malleable ends averaged 0.07 per cent of phosphorus. The amount of this impurity is extremely high, the maximum permissible under the specifications of the American Railway Association being 0.045 per cent of phosphorus.

It might be suggested that the brittleness of the tubes is due to the original stresses set up in expanding. In order to ascertain if this were the case, portions of two separate "brittle" tubes were taken from unaffected parts of the tube made into rings and expanded in the usual way. The Brinell hardness was in one case increased from 111 to 156, and in the other from 131 to 143, but in neither case did the metal become brittle.

The author suggests that the brittleness is due to the repeated stresses set up during the work of the locomotive, acting on material already in a state of stress, regard being had for the high phosphorus content of the metal. On the Midland Railway there are about 6,000 of these tubes in service, and with one odd exception, these eight tubes are the only ones known to be brittle. The phosphorus in the great majority of the tubes in use may be taken as being low.

*From a paper by Sir Henry Fowler, presented before the Institution of Mechanical Engineers, London, Eng., and abstracted in the Iron Age.

Vitalizing Locomotives to Improve Operation

Present Conditions Can Only Be Met Successfully by Utilizing All Factors That Increase Capacity

BY GEORGE M. BASFORD

NOTHING our railroads have done in recent years is more potent in solving present and will be more effective in solving future transportation problems than the improvement in the locomotive and improvement in its operation. Nothing can prevent success. The railroads have clearly shown the way to reduce the cost of transportation by what they have already done. It remains to follow this path intensively. Transportation equipment is again coming to the test of the advance of a vast and growing nation. Vitalize the power that the country depends upon. Vitalize it to reduce cost. Vitalize it for increased capacity.

The times call for directness, for elimination of the unnecessary, for effectiveness, for efficiency. That the railroads have made wonderful progress should be made known to the public. That means are at hand for even greater accomplishments is known to every railroad man. Getting trains over the road has been the absorbing problem of the past. Getting them over the road and at lowest cost is the problem of the present and will be that of years to come. The locomotive of today is ready for its part in this.

Heavier Engines

For about 70 years there was no fundamental improvement in our locomotives in ways that made a pound of metal and a pound of coal do more work. For 70 years locomotives were small. They were well adapted to the service required. It was not severe service. The machine conformed closely with conditions of the time. When the heavy train load period came, engines were made larger, heavier and more powerful. For years the railroads had no other way to overcome increased cost of operation but by building larger locomotives. Costs went up and rates came down. This was met as long as it could be met by building larger and heavier engines. The public should be shown that this was done and well done. This continued until about 15 years ago when the largest locomotives reached the limit of the human fireman. This limitation revealed the necessity for providing higher efficiency.

Up to this time simplicity of construction was the designer's compelling rule. There could be no complication. Locomotives had to be as simple as a grindstone. The prejudice against so-called "complication" served, for a time, seriously to delay improvements, but far-seeing, courageous officials began to understand that certain results must be attained, and that well designed, well constructed improvements must be accepted and must be cared for in order to secure those results. This objection to complication is a relic of the past. It yielded when mere increase of size and weight did not suffice.

Successful Improvements

Until 19 years ago when the superheater made its advent on this continent, there was no persistent, systematic, successful improvement increasing the power capacity of the American locomotive, through increased efficiency in the use of heat.

With and largely as a result of the development of the superheater and the improvement of the arch came a revolution from rule of thumb to scientific design of locomotives as a whole. Heating surface, firebox volume, tube surface and boiler design throughout began to be based on the amount of steam the cylinders required. Other very important improvements became successful. Improved valve gears, automatic stokers, combustion chambers, firebox improvements, automatic fire doors, power reverse gears—all these have been brought to practical success during the present official generation. Latest of all are the feed water heater and the booster. The seven principal capacity increasing factors that mean most in the present situation that calls for capacity with efficiency and fuel conservation are the air brake, the superheater, brick arch, feed water heater, booster, mechanical stoker and light reciprocating parts of improved steel.

Six of these factors increase the capacity of the locomotive by increasing its horsepower and the air brake by making it possible to control long trains and by shortening stopping distance. They do not require increase in weight of rail or increase in strength of bridges. They are now playing a vital part in the welfare and the business of the country and they are helping and are ready to still further help reduce the cost of transportation.

That the policy of many railroads in recent years in equipping new engines and many old ones with two or more of the capacity increasing factors was eminently wise has been proven and judgment rendered. If this policy had not been adopted the record breaking ton mileage of the year 1920, without materially increasing the number of locomotives in service would have been impossible. It was the capacity increasing factors built into new locomotives of the past few years, the incorporation of these factors into many old engines, and the conversion of old engines into up-to-date ones that did it. This demonstration justifies the policy of equipping so many old engines with improvements that compel a ton of coal to do more work. That policy has made good completely. These capacity increasing factors are ready to do more than anybody realizes. Only the surface has been scratched.

This Is Ready Now

A certain large passenger locomotive, built five years ago, and which was up-to-date at that time, was being taxed to its capacity. It had reached its limit of load and speed. It had no reserve for bad weather or unusual conditions of service. A thorough study reveals the fact that this locomotive, already among the largest and most powerful of its class, may be replaced by one of the same type, but giving 58 per cent more starting drawbar pull, producing 30 per cent more drawbar pull at 60 miles per hour and with no more destructive effect upon the track than the present engine at 60 miles per hour, the destructive effect at 70 miles per hour, being less than that of the present engine. In this study absolutely nothing new or untried was contemplated. Refinement of design was considered, also enlarged capacity by a specially high degree of superheat, an improved firebox, the arch, light reciprocating parts of high grade steel, plus the booster to give greater starting power.

Think a moment of the operating advantages to be had from over 50 per cent more starting power and 30 per cent more drawbar pull at 60 miles per hour. This design did not include the feed water heater because it was not ready for consideration at the time. Heating the feed water by

*From a paper presented before the New York Railroad Club, May 20, 1921.

waste steam would still further increase the power of this engine.

Any builder may build this engine. It is the first example, of which I have record, of a design for high power, which was prepared co-operatively by a railroad, a locomotive builder and by the engineers of the concerns which are devoting themselves to improvements for increasing capacity. Similar improvement is available to any railroad.

Of course, such a locomotive will cost more than a weak and obsolete one. It will, however, increase operating speed, reduce double heading, will apply high wage crews more effectively and will cheapen operation.

This increased power per engine will reduce the number of engines required to do a given amount of work. This will reduce maintenance. Obviously, it is easier to maintain two engines with these capacity increasing factors than to keep up three without them. The cost of these improvements is now going into coal and wages. It may go into new engines when by improving old ones the new ones will not for a time be needed.

Progress

Progress in the use the railroads are making of locomotive improvements is revealed by many examples of heavy trains and fast schedules. Here are three:

First: A well known road has increased its average revenue tonnage from 400 tons to 1,700 tons per train in 25 years, the maximum revenue tons handled in a regular train being 3,200. This road shows 233 per cent increase in weight of train and 66 per cent increase in speed in 25 years. It hauls 5,000 ton trains on 25 mile schedules. It makes excellent use of improved locomotives. In five years the average revenue train load of the country as a whole increased from 475 tons to 728 tons, or an increase of over 53 per cent since 1915.

Second: The 20th Century is the direct successor of the World's Fair Flyer of 1893 and represents continuous development. The weight of that train has increased 215 per cent and its speed has increased seven per cent. *Only an improved locomotive can haul it today.*

Third: Consider the fact that the heaviest passenger trains on one of the Western roads weigh 1,290 tons and are on fast schedules with maximum speed of 68 miles per hour. It is only 25 years ago that the newspaper men of New York were invited to see a 600 ton passenger train slowly pulled out of the Grand Central Terminal by what was then considered a monster locomotive. That locomotive is now hauling a milk train on a branch line. It and its class have given place to really powerful ones that were not then dreamed of. Today the fastest long distance trains in the country weigh twice as much as the exhibition train referred to. Until we are reminded of the past we do not appreciate what the railroads have accomplished.

Capacity First

In the usual sense of the expression saving fuel will not greatly reduce the cost of transportation, but conserving fuel by compelling every pound to yield more power will do so because it involves operation as well as engineering improvements. Power to get the maximum business delivered is the cheapest power. Heavy pulling at favorable speeds will reduce cost and as congestion increases, speed becomes a greater factor. Power to keep trains on time, to get through storms, to get in under the overtime limit is what is needed. Let us take a glance at some of the power increasing, capacity increasing factors with a view of giving the operating officer greater power capacity to work with. Many others are important and would be discussed here if time permitted.

Brick Arch

For many years arches have been used in locomotive fireboxes. Their function is to baffle the gases and flame on its way to the flues. They mix the gases from the fire, aiding combustion. They cause the burning of many of the cinders and they protect the flues from streams of cold air from the fire door, or from holes in the fire. They protect flue sheets and materially reduce honey-combing. Arches increase the heat making capacity of coal and reduce boiler failures, thus increasing the availability of engines. Success of the present arch and arch practice is due to structural improvements in the bricks themselves and in methods of support that renders renewal easy and to improved firebox design. Over 43,000 locomotives now have these arches. Every engine fit to run at all should be equipped on coming out of the shops if it did not have an arch when built. There is no other capacity increasing factor so easily and so inexpensively applied to existing locomotives.

Superheater

To this improvement the largest increase in locomotive capacity is due. The heavy trains of today could not be handled without superheaters. In June, 1910, the Superheater Company got fairly started. Since 1910 our railroads have applied 33,000 superheaters to new and old locomotives, about 90 per cent of new ones having been equipped during the past few years. The application to many more existing engines offers a promising opportunity to still further reduce the cost of transportation. It is a financial error to operate any locomotive today without a superheater, and the penalty is perpetuated as long as the engine runs.

Feed Water Heaters

This conservation factor is the first to utilize waste heat. It gives back to the boiler heat that is on its way to waste. For generations stationary and marine steam plants have used feed water heaters as a matter of course. The application to locomotives has been attempted many times and has waited only for practicable heater and pump. Thousands of European locomotives are already equipped and several thousand are being applied every year.

For over four years feed water heaters raising the temperature of the water from 40 to 50 degrees to from 230 to 250 degrees have been in successful service on locomotives in this country. These equipments also return for use again about 15 per cent of the exhaust steam in the form of water that has been distilled and filtered. This increase in the tender tank capacity is important in operating because of the ability to save some water stops.

Heat from the exhaust steam is returned to the boiler, giving the boiler less work to do. Therefore, less coal is burned to do a given amount of work or more work is done for the same amount of coal. Feed water heating is a success.

Booster

This capacity increaser is well named. It boosts a heavy train in starting and also on the critical points on grades. It is the latest improvement. It supplies an ideal method of utilizing weight and steam that is not needed for other purposes at low speeds and only at the time that the boost is wanted.

When the train is going the demand for steam is greatest. Immense boilers are needed at speeds. There is a surplus of boiler power when starting and at low speeds. The big boiler requires trailing wheels to carry it. This weight on trailing wheels is also a surplus when starting or when running slowly. The booster couples up this surplus steam and idle weight, making both useful to get the train going and to keep it from stalling on ruling grades. Usually there are a few points on a division which determine the load an engine can haul over the entire division. If these are mastered the rest is easy. This is one of the booster functions. Another is in starting a heavy train, getting it out of a siding or

through the switches of a yard. Here is where the 70 to 100 feet of slack between the cars of a long train causes havoc with draft gear. The booster works like an automobile in low gear. It applies its extra power smoothly, avoiding the jerks that a big engine otherwise must give to get going at all.

Again, it solves the problem of the big passenger engine. With 20 to 25 per cent more starting power backing up to take slack is avoided, eliminating the frequent five to 10 minutes' delay in getting a heavy train moving every time it stops. Operating men will appreciate this advantage, especially when they have big passenger trains in several sections, each losing minutes every time they start, especially when they start on grades.

The booster will help keep passenger trains on schedule and the road clear for freight. It puts in your hand the means for placing any engine having trailing wheels into the class above itself in starting capacity. It is as good as another pair of drivers but avoids the larger cylinders, heavier rods and extra weight that these drivers entail and which are wanted only in starting. In fact the booster is better than another pair of drivers because it changes trailing wheels into drivers when wanted, and then changes them back into trailers when the pull is reduced after the wheels are rolling. This is conservation of the highest order.

Control is semi-automatic, giving the enginemen the maximum resource for starting power and a negligible minimum of attention or mental effort. Tests on a large railroad show for the booster the following results on a Pacific type freight engine:

1. An increase of 23 per cent in train tonnage, or
2. An increase of 12 per cent in speed on the division in question.
3. An increase of 18 per cent in drawbar pull at 7½ miles per hour.
4. An increase of 13 per cent in drawbar pull at 13 miles per hour.
5. An increase of 22 per cent in starting power.

It is an important tonnage increaser. It is capable of doing more to reduce the cost of transportation than any locomotive improvement except the superheater, and it does more to supplement the superheater than any other factor available.

David L. Barnes will long be remembered for advocating the wide firebox for locomotives. The change "came hard." Dr. Goss helped it immensely with his grate area test at Purdue. At first fireboxes were extended over the frames, but this was not enough. In those days locomotives had leading trucks and the rest of the wheels were drivers. The real wide firebox, needed for steam making at speed, brought the trailer axle with its "idle" wheels. We hated the thought of wheels under a locomotive that did not work. This explains the struggle of the Prairie type which persisted until distrust of pony trucks at high speeds effectively buried that type of engine. We gave up not gracefully but under force. Next we became blind to the "idle" weight and went ahead until the country has a lot of it. The booster has given back what was lost and more. The booster uses this idle weight by applying power to the trailers.

Someone will say: "You are talking power and more power. We have too much power now and are compelled to run big, powerful Pacific type engines on light local passenger trains of five and six cars." Let me answer "yes." This work is being done with big engines because lighter ones will not make the time with the frequent stops of local trains. Put boosters on old Atlantic type and the lightest Pacific type engines that have been superheated and do this work with these engines that are suitable for it.

Increase of Capacity

The accumulated increase of capacity due to the superheater, arch, feed water heater and booster in indicated in Fig. 1. At 45 miles per hour the increased power due to these factors is 79.7 per cent, when they are applied in combination. This is now considered too high speed for such a heavy engine. These combined curves indicate that at 30 miles per hour the power increase for the same coal is 50 per cent, at 25 miles per hour 40 per cent, at 20 miles per

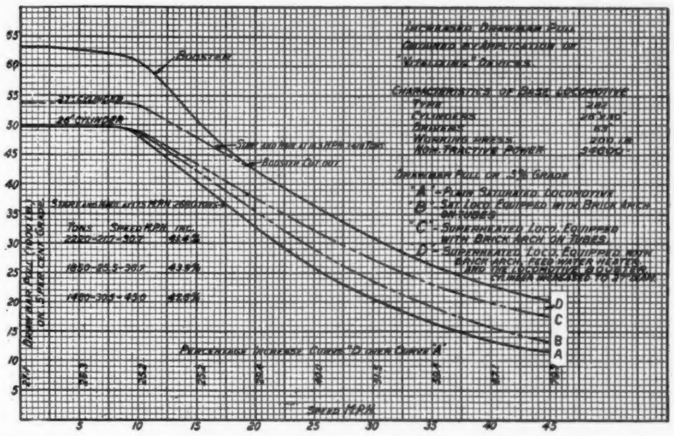


Fig. 1—Increased Drawbar Pull Obtained With Capacity Increasing Devices

hour 29 per cent. The diagram also shows the increase in the speed possible with the same load and fuel in case speed rather than heavier loading is wanted. At 30 miles per hour two engines completely equipped give as much power as three "plain" engines. The increased power in this case costs half that of another plain engine and the cost of maintaining two sets of improvements will be less than the cost

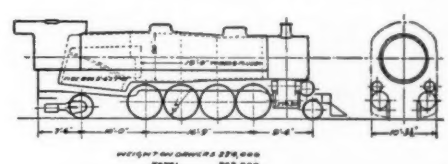


Fig. 2—A Typical Improved High Capacity Locomotive

of maintaining another complete plain engine. The base engine in the case is the Administration light Mikado, as it would appear if built without any of the improvements we are discussing. If greater drawbar pull, due to these improvements, is not desired, the curves show the increased speed that may be had with any given pull.

Fig. 2 outlines an engine equipped to give this power.

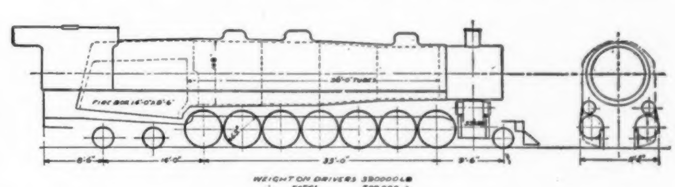


Fig. 3—A Plain Saturated Locomotive to Deliver the Same Drawbar Pull at 45 Miles an Hour as the Engine Shown in Fig. 2

The absurdity of trying to get it without the efficiency factors is shown in Fig. 3. This engine (Fig. 3) is as "simple as a grindstone." A plain engine to do this work would be a freak that could not be put on any railroad. Look at the wheels, the flue length, the size of the firebox and then think of what this means. I cannot present a better demonstration.

The fuel consumption as affected by these capacity fac-

tors is shown in Fig. 4. Of course, increased power means stronger cars, longer sidings and removal of other physical restrictions which in every case are paying business propositions.

High Quality Steel Reciprocating Parts

High quality steel forgings if applied to the reciprocating parts of the United States Railroad Administration heavy Mikado locomotives reveal an interesting possibility. Both light and heavy Administration Mikados were actually built with reciprocating parts of open hearth steel. The results in rail pressures which would be obtained if the heavy Administration engine had been built with high quality steel reciprocating parts of light weight are shown in Fig 5. The first sets of figures show the rail pressures of the light Mikado with open hearth reciprocating parts at rest and at different speeds. The lower figures in each case show the rail pressures of the heavy Administration Mikado if fitted with light parts of high quality steel. These are shown at rest and at speeds of 35, 40, 45 and 55 miles per hour. At speeds between 40 and 45 miles per hour the light Mikado becomes more destructive to the track because of driving wheel pressures than the heavy Mikado when equipped with light reciprocating parts. In other words, at all speeds where the engines are likely to damage the track the heavy Mikados with light parts are safer engines than the light Mikados with heavy parts. In this comparison, it should be borne in mind that the heavy Mikado has 10 per cent more tractive power than the light one and 14 per cent more heating surface. The total weight of the heavy Mikado is 9½ per cent greater than the light one. As railroad officers with track and bridge responsibilities, which engine would you choose? Remember that the heavy one has 10 to 15 per cent greater capacity than the light one.

Stokers

Locomotives of greatest power when coal is the fuel have passed the physical capacity of the fireman to maintain steam enough to supply the large cylinders that present operating conditions demand. As the result of development in the

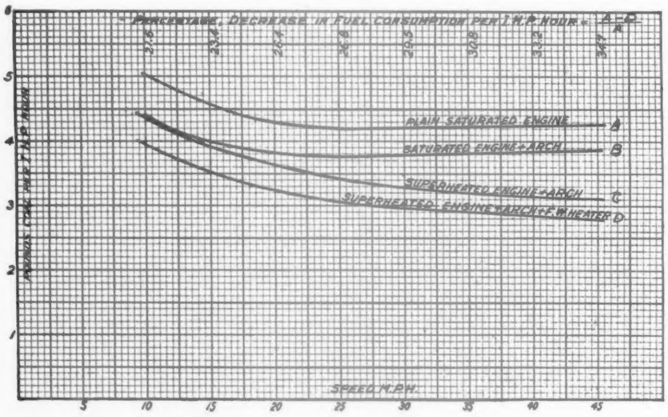
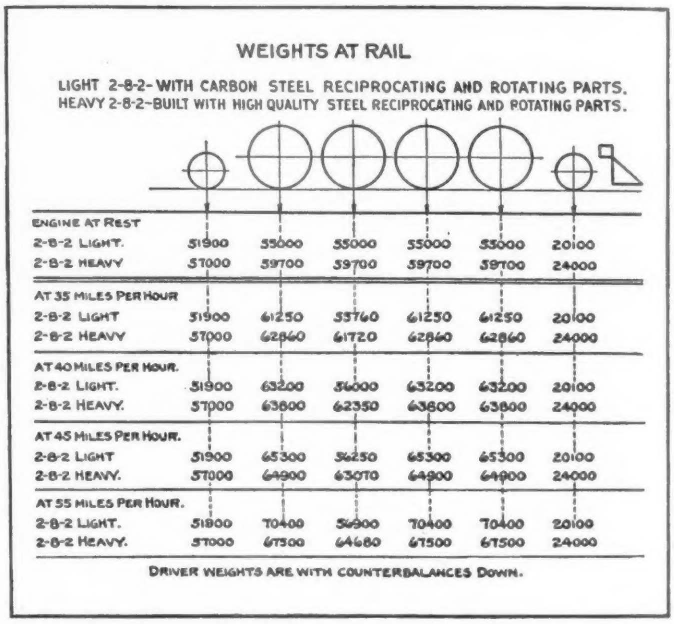


Fig. 4—Fuel Consumption of Locomotives With and Without Power-Increasing Factors

severest service known, mechanical stokers are ready not only for present needs but they provide reserve capacity for years to come. In considering the stoker, the chief question is one of increased capacity to get the power from the tender to the grates, in order to get the greatest loads over the road at the least cost. The vital question is the provision of the horsepower at speeds that bring economy in use of tracks and yards and economy in the application of high wage schedules and prohibitive overtime. The stoker development began at about the right time to be ready for power demands that are coming. Power stokers emancipate the big locomotive from the limitations of the human fireman. They render it possible to operate locomotives that require too much coal for the ablest of firemen to handle. They also provide means for getting higher horsepower out of engines at high speeds than otherwise would be possible.

Air Brakes

Air brakes have increased the capacity as well as safety of railroads. By improved brakes alone the capacity of the New York Subway was more than doubled. Without highly efficient air brakes heavy trains could not be run at



ENGINE AT REST						
2-8-2 LIGHT.	51900	55000	55000	55000	55000	20100
2-8-2 HEAVY	57000	59700	59700	59700	59700	24000
AT 35 MILES PER HOUR						
2-8-2 LIGHT	51900	61250	55760	61250	61250	20100
2-8-2 HEAVY	57000	62860	61720	62860	62860	24000
AT 40 MILES PER HOUR.						
2-8-2 LIGHT.	51900	63200	56000	63200	63200	20100
2-8-2 HEAVY.	57000	63800	62350	63800	63800	24000
AT 45 MILES PER HOUR.						
2-8-2 LIGHT	51900	65300	56250	65300	65300	20100
2-8-2 HEAVY.	57000	64900	63070	64900	64900	24000
AT 55 MILES PER HOUR.						
2-8-2 LIGHT.	51900	70400	56900	70400	70400	20100
2-8-2 HEAVY.	57000	67500	64680	67500	67500	24000

DRIVER WEIGHTS ARE WITH COUNTERBALANCES DOWN.

Fig. 5—Decrease in Rail Pressure Effected by Using High Quality Steel

all. This great subject is merely mentioned here, but it must be considered in connection with the future because today the improved equipment of brakes is in the lead of common practice.

Look Forward

New locomotives are going to last almost indefinitely when kept up-to-date as to modernizing. They lose their useful lives only by obsolescence. The design of new equipment is therefore of the utmost importance and someone on the road should be charged with the responsibility of looking ahead and determining what new engines are to be, long enough in advance to be sure that they absolutely fit conditions as they are and that they will fit as nearly as may be conditions that are to come. This involves a deep study of operation in all its phases. It seems obvious that the general manager or operating vice-president would find his job much easier if every new engine built should receive the same attention that the building of every new big bridge receives. But bridge design is a routine. Locomotive design is improving so fast that most of us cannot keep up with it. The new engine question in itself is a big task, offering great possibilities.

Then comes the question of the existing power and what may be done to it to increase its capacity, increase its pulling power, reduce its failures on the road, to quicken and cheapen the maintenance work and to increase its thermal efficiency and the number of hours that it is available. This involves intimate knowledge of progress in machine tools, in labor-saving equipment, in equipment of locomotive terminals and particularly equipment for running repairs at the roundhouses. Some of the roads are approaching this ideal now. The roads which come nearest to doing it are those which

are making best use of their power, and which are in the best shape financially.

The kind of problems which need working out are represented by a study of locomotive drawbar pull which will show whether it is cheaper to increase the power of locomotives or to cut down a certain grade. The money value in reduced cost of operation due to reducing certain grades is already well worked out. It is practically reduced to a formula, but the effect of increased drawbar pull needs to be reduced to a formula. This would at once reveal the money value in operation of increasing the drawbar pull of a Mikado by 50 per cent at a speed of 30 miles per hour or by nearly 30 per cent at 20 miles per hour. Another study of great value is that of considering available drawbar pull hours of locomotives as if it were a deposit in the bank. Figures that show how much of this deposit is used under daily conditions and how much it can be increased by relatively small expenditures offer a promising field for saving.

Because of the improvements of 20 years the locomotive, its construction, its operation and its maintenance presents the trump card in the reduction of the cost of transportation in the present emergency. That card has been well played, play it now to win.

In conclusion there are two very important points which I do not wish to leave either unsaid or unheeded:

First: In emphasizing the importance of all these items of modernizing, of vitalizing, locomotives we have discussed tonight, I wish to make most prominent the first and greatest obligation of the railroad companies, namely, their responsibility to their owners and stockholders, who first and above all others are entitled to a fair return upon their investments.

Second: As I have already attempted to point out railroad managements have done and are doing wonderfully well in the application of capacity increasing factors to locomotives to augment power. These improvements will by necessity result in substantial savings. There are, however, additional means of economy which are not so closely hooked up with pure problems of capacity increase. These must be further considered by themselves. Funds for carrying out programs in this direction will be made available quickly when the possibilities and necessities are fully appreciated.

Discussion

W. E. Woodard (Lima Locomotive Works): One of the most marked results of the developments so clearly shown in this paper is the effect of these developments on the speed of the locomotive. For example, Fig. 1 indicates that a thoroughly modernized locomotive is good for an increased speed of from 40 to 48 per cent with the same train load over a plain locomotive; and this using the same amount of coal.

Railway operating officers are now realizing as never before the value of intensive railroading. "Speed up operations to increase earnings" is their aim because they realize that there is a sound economic basis for so doing. Overhead charges are fixed. Administration expenses, roadway, signals, terminals and cost of equipment are stationary. No matter how many cars are moved over the line charges on this overhead must be paid. It is a definite sum for every hour in the day. The more productive work that can be crowded into the hour, the more cars hauled, the more economical is the operation. It is almost exactly analogous to a manufacturing plant where high-speed tools and quick handling of the products is absolutely essential to economic production. The railway executives, the roadway, the signals, the terminals and the equipment are the plant. Locomotives are the tools.

The locomotive is the most important single item in speeding up production; other factors, such as terminals, signals, roadway, are contributory factors. They can hold back the speed of production, but in and of themselves, they cannot get speed of production without locomotives suitable for the job. I realize, of course, that there is a limit beyond which freight train speeds are not economical, the same as speed of production in a manufacturing plant is limited by the strength of the tools and other physical conditions of the equipment.

The diagrams clearly show that every one of the developments mentioned by Mr. Basford has been a decisive factor in the speeding up process. The booster, one of the latest of the developments, lends itself most admirably to this need. It can be applied to a locomotive whose characteristics are suitable for high freight train operating speeds and give it the starting power of a heavy drag freight locomotive.

I looked at Fig. 3—the absurdly impossible design of plain saturated locomotive, and my first thought was to question the accuracy of the showing. I dug up a 1906 Locomotive Dictionary and picked out ten of the best designs illustrated. For that time they were good locomotives—the best in the country on the best lines. These engines showed from 65 to 77 h.p. per 10,000 lb. weight of engine. Fig. 3 gives 70 h.p. per 10,000 lb. weight of locomotive. In other words, Fig. 3 compares very favorably with the best of the 1906 engines for horsepower output per 10,000 lb. of weight. At the present time we are getting 95 h.p. per 10,000 lb. of engine weight. With all the modern developments on a locomotive we can get over 100 h.p. per 10,000 lb. of weight. Fig. 2 gives 101 h.p. This increase in horsepower per unit of weight is the real measure of the development. The things Mr. Basford has been talking about have put up the horsepower output from 70 per 10,000 lb. to over 100, and that is the factor which really counts in railroad production. Capacity, which to the engineer means horsepower; which to the railroad executives means cars per hour, or tonnage production, is the answer to our railroad problem. It is one thing the railroads themselves can control, and with it they can get the answer.

D. F. Crawford (Locomotive Stoker Company) reviewed the increase in the average train load during a period of 30 years. He pointed out that the development of the stoker was brought about to increase still further the tons per train. As locomotives increased in size the full benefit of the additional tractive effort was not realized in operation with hand fired engines. The stoker furnished a means of getting full capacity from each unit as it removed limitations on the quantity of coal that could be fired in a given time. Mr. Crawford pointed out that while combustion efficiency is lower at high rates of firing, the increased consumption of fuel is less important than the increased capacity of the motive power. Under suitable conditions from 15 to 20 per cent increase in train load can be gained by the use of the stoker. If it is not desirable to increase the train load, the stoker can be used as a means of decreasing the time on the road with the same rating.

W. L. Bean (N. Y., N. H. & H.) spoke on the practical limitations in the application of devices to increase capacity. He stated that full benefit cannot be derived from these appliances unless the locomotive can be operated nearly at its full capacity. The railroads had adopted devices that would effect economies as soon as they were developed to insure satisfactory reliability. Where the traffic is heavy and the service regular, all the accessories mentioned by Mr. Basford could be used profitably but in some classes of service they were not applicable. Mr. Bean touched on the maintenance problem stating that modern locomotives demand adequate facilities for maintenance and require that the forces be educated to keep them in condition. As the design of locomotives improves, the facilities must be developed concurrently; otherwise the savings obtained under test conditions vanish in service and are absorbed in routine charges so that the loss is not noticed. He told of the excellent results obtained with feed water heaters in freight service where the saving in water consumption made it possible to run 65 miles between water stops in freight service.

Air Brake Association Holds Executive Meeting

Papers Are Presented Without Discussion; Report of Extensive Tests of Steam Heating Apparatus

IN lieu of the twenty-ninth annual convention, which was postponed because of the prevailing business depression, the Executive Committee of the Air Brake Association held an open meeting at the Hotel Sherman, Chicago, on May 3, for the conduct of the essential business of the Association and to receive the committee reports and papers prepared for presentation and discussion at this year's convention. The reports and papers were presented in abstract only and were received without action or discussion, it being the plan of the executive committee to issue them to the membership in proceedings form and to bring them up at the next regular convention for final disposition by the membership as a whole.

The following reports and papers were presented: Report of the Committee on Recommended Practice; Tests of Steam Heating Apparatus on Locomotives and Passenger Cars, Montreal Air Brake Club; Terminal Tests to Insure Effective as Well as Operative Brakes, Pittsburgh Air Brake Club; The Schedule "U C" Brake; the Brake Pipe Vent Valve, Central Air Brake Club; and Report on Air Consumption of Locomotive Auxiliary Devices.

The paper describing the tests of steam heating apparatus conducted by the Montreal Air Brake Club is abstracted below and other reports will be published in the July issue.

Tests of Steam Heating Apparatus

Submitted by the Montreal Air Brake Club.

A committee of the Montreal Air Brake Club was appointed to investigate to what extent improper size of piping, starting valve, steam heating reducing valve and flexible conduits interferes with the heating of passenger trains by steam from the locomotive. The committee was able, through the courtesy of the Canadian Pacific, to complete a set of tests during the month of November, 1920.

The committee has concluded its work. On the contrary, there is much remaining to be done, but it is considered, owing to the importance of some of the features brought to light, that the facts should without further delay be made available to all concerned.

The particular points upon which information has been sought to date might be listed as follows:

First—Comparison of capacities of 1½ in. and 2 in. steam pipes on locomotives and tenders, 1 in. by 1½ in; 1½ in. by 1½ in. and 1½ in. by 2 in. regulating valves, 1½ in. standard steam hose and 1½ in. and 2 in. metallic connections between engine and tender.

Second—After determining what appears to be the most suitable combination of locomotive steam heat apparatus available, whether such combination with present standard adjustments of regulating valve is of adequate capacity for modern train lengths and the extremely low temperatures occasionally met.

Third—To what extent can the capacity of locomotive apparatus be increased by higher adjustment of regulating valves, and changing of locomotives at terminals be facilitated thereby?

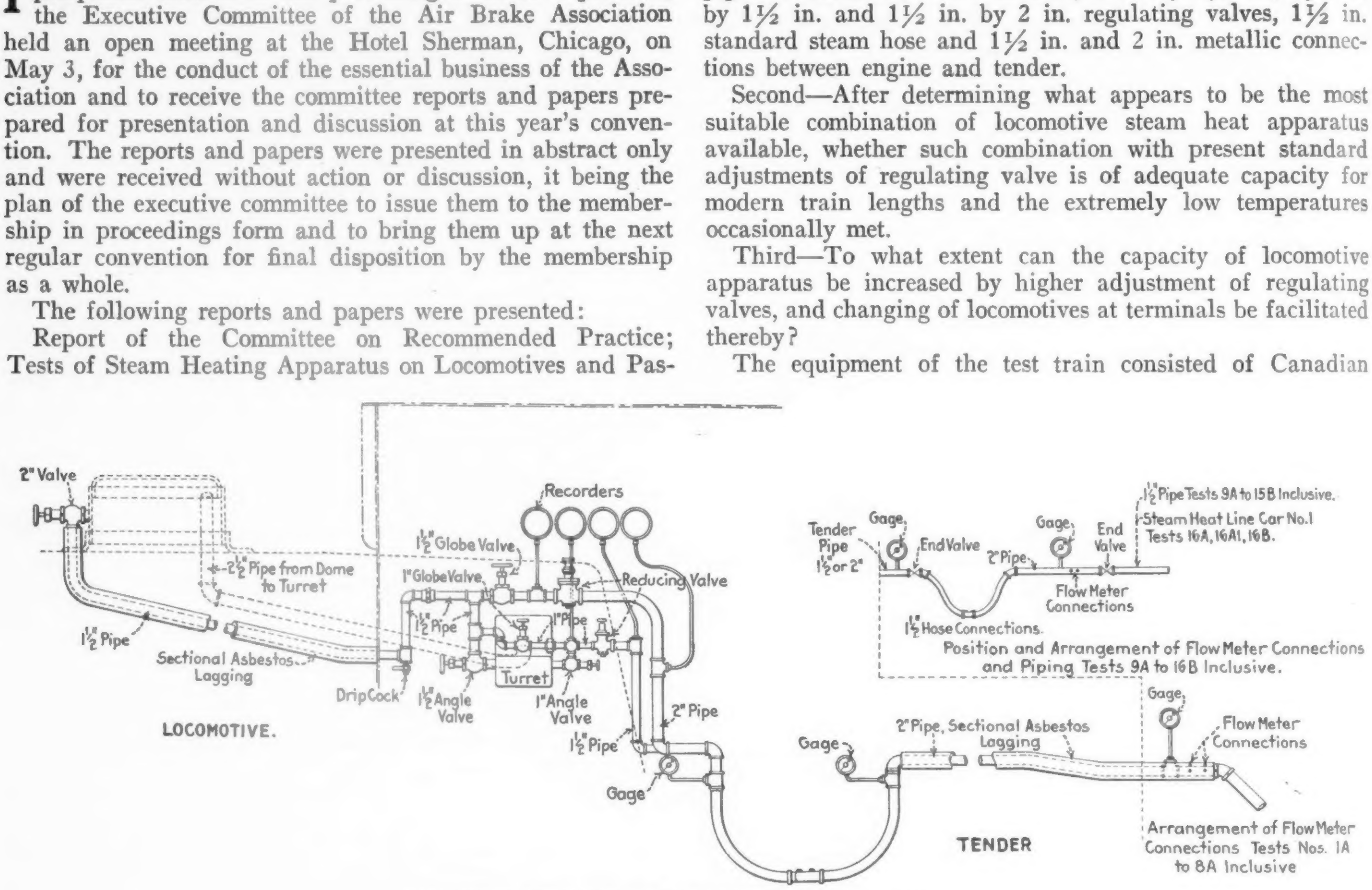


Diagram of Locomotive and Tender Piping and Fittings

The equipment of the test train consisted of Canadian Pacific passenger locomotive No. 2596 and the following 18 cars, selected without regard to construction or type of heating system:

	Construction	Heating system
Baggage	Wood	Gold
Sleeper	Wood	Gold
Diner	Wood	Gold
Tourist	Wood	Gold
Diner	Wood	Gold
Diner	Wood	Gold
Diner	Wood	Gold
Diner	Wood	Gold
Tourist	Steel	Vapor
Diner	Wood	Gold
Tourist	Steel	Vapor
Tourist	Steel	Vapor
Tourist	Wood	Gold
Tourist	Wood	Gold
Sleeper	Wood	Commingler
Diner	Wood	Gold
Sleeper	Wood	Commingler
Sleeper	Wood	Gold

All tests were made with the train at rest, on two adjoining tracks in the Glen Yards at Montreal. The engine and nine cars occupied one track, the connection to the remaining cars being made with 18 ft. of 2-in. pipe, heavily insulated.

Total length of 2-in. main steam pipe under cars	1,398 ft.
Total length of hose on 18-car train	87 ft. 6 in.
Total length of radiating pipe inside of cars	3,549 ft. 6 in.
Total	5,035 ft.

The train was equipped throughout with positive lock couplings with gravity release trap.

A diagram of the locomotive and tender piping, as well

TABLE NO. 1—STEAM HEAT TRAIN LINE CHARGING TESTS

Test of	Normal temperature, deg. F.	Duration Min.	Duration Sec.	Type and size connection between engine and tender		Size of steam pipes, in. Engine	Size of steam pipes, in. Tender	Steam from turret or dome	Injector or blower operated	Size and type of regulator	Size of steam valve, in.	Steam valves inside car
Test of 18-car train—												
1 A	42	40	5	Hose	1½	2	2	Turret	No	Type B, 1 by 1½	1	Open
3 A	40	45	..	Hose	1½	2	2	Turret	No	Type B, 1½ by 2	1½	Open
3 B	41	6	21	Hose	1½	2	2	Turret	No	Type B, 1½ by 2	1½	Open
4 A	42	25	47	Hose	1½	2	2	Turret	No	Type C, 1½ by 2	1½	Open
4 B	43	15	..	Hose	1½	2	2	Turret	No	Type C, 1½ by 2	1½	Open
5 A	43	11	50	Hose	1½	2	2	Dome	No	Type C, 1½ by 2	1½	Open
Test of 9-car train—												
7 A	31	1	38	Hose	1½	2	2	Turret	No	Type C, 1½ by 2	1½	Open
7 B	29	1	44	Hose	1½	2	2	Dome	No	Type C, 1½ by 2	1½	Open
8 A	29	2	6	Hose	1½	2	2	Turret	Both	Type C, 1½ by 2	1½	Open
Test of locomotive equipment—												
9 A	30	5	..	Hose	1½	2	2	Turret	No	Type B, 1½ by 2	1½	.....
9 B	39	5	..	Hose	1½	1½	1½	Turret	No	Type B, 1½ by 1½	1½	.....
10 A	30	5	..	Met. E	2	2	2	Turret	No	Type B, 1½ by 2	1½	.....
10 B	39	5	..	Met. E	1½	2	2	Turret	No	Type B, 1½ by 2	1½	.....
11 A	30	5	..	Met. D	2	2	2	Turret	No	Type B, 1½ by 2	1½	.....
11 B	43	5	..	Met. D	1½	2	2	Turret	No	Type B, 1½ by 2	1½	.....
12 A	42	5	..	Met. E	1½	1½	1½	Turret	No	Type B, 1½ by 1½	1½	.....
12 B	40	5	..	Met. D	1½	1½	1½	Turret	No	Type B, 1½ by 1½	1½	.....
13 A	48	5	..	Hose	1½	1½	1½	Turret	No	Type B, 1 by 1½	1	.....
13 B	49	5	..	Hose	1½	1½	1½	Turret	No	Type B, 1 by 1½	1	.....
14 A	47	5	..	Met. D	1½	1½	1½	Dome	No	Type A, 1½ by 1½	1½	.....
14 A1	49	5	..	Met. D	1½	1½	1½	Turret	No	Type A, 1½ by 1½	1½	.....
14 A2	48	5	..	Met. D	1½	1½	1½	Turret	Both	Type A, 1½ by 1½	1½	.....
14 B	48	5	..	Met. D	2	2	2	Dome	No	Type A, 1½ by 2	1½	.....
14 B1	49	5	..	Met. D	2	2	2	Dome	No	Type A, 1½ by 2	1½	.....
14 B2	46	5	..	Met. D	2	2	2	Turret	No	Type A, 1½ by 2	1½	.....
14 B3	47	5	..	Met. D	2	2	2	Turret	Both	Type A, 1½ by 2	1½	.....
15 A	48	5	..	Met. D	1½	1½	1½	Dome	No	Type B, 1½ by 1½	1½	.....
15 A1	48	5	..	Met. D	1½	1½	1½	Dome	No	Type B, 1½ by 1½	1½	.....
15 B	48	5	..	Met. D	2	2	2	Dome	No	Type B, 1½ by 2	1½	.....
Test of 13-car train—												
16 A	38	..	..	Met. D	2	2	2	Turret	No	Type A, 1½ by 2	1½	Open
16 A1	35	..	..	Met. D	2	2	2	Turret	No	Type A, 1½ by 2	1½	Open
16 B	35	..	..	Met. D	2	2	2	Turret	No	Type C, 1½ by 2	1½	Open

Test of	Gage and recorder readings on locomotive, lb. per sq. in.: Boiler pressure			Regulator: Ahead of		Regulator: Back of		Rear of engine		Front of tender		Back of tender		Flow meter readings: Av. flow lb. steam per min.	Equivalent boiler h. p. (per hour)
1 A	190	190	180	172	162	64	59	57	52	55	50	55	50	20.7	42.5
3 A	195	195	183	186	174	61	58	55	57	52	54	52	52	21.7	44.8
3 B	193	193	188	178	175	93	89	90	88	85	84	83	82	31.7	65.9
4 A	195	195	188	186	180	57	58	56	57	52	54	52	54	21.7	44.9
4 B	190	190	188	175	175	86	88	85	87	82	82	80	80	30.6	63.5
5 A	195	195	190	180	175	90	88	87	87	82	83	81	83	31.5	65.4
7 A	182	182	182	150	150	59	59	58	58	53	54	..	..	**	....
7 B	**	**	**	**	**	**	**	**	**	**	54	..	..	**	....
8 A	195	190	180	150	142	59	59	59	59	52	54	..	..	**	....
9 A	190	190	190	152	152	60	60	59	59	46	46	44	44	43	88.3
9 B	198	198	198	167	167	60	60	54	54	45	45	38	38	23	47.0
10 A	190	190	183	150	143	60	62	59	57	49	47	46	45	45.4	92.3
10 B	195	195	193	162	160	60	58	57	56	40	39	38	38	32	65.5
11 A	195	195	185	155	145	61	61	57	57	52	52	50	50	47.7	97.9
11 B	200	200	195	165	160	59	59	56	56	45	45	44	44	39.5	81.1
12 A	195	195	193	167	165	60	61	52	50	37	39	32	33	20	40.9
12 B	195	195	190	163	158	60	60	53	53	44	45	39	39	22.5	46.0
13 A	..	193	188	155	150	59	57	52	51	42	41	40	39	22.8	46.3
13 B	..	190	180	145	138	76	69	66	61	55	51	50	46	26.3	54.0
14 A	..	193	188	159	154	60	60	52	53	42	43	37	39	22.4	45.8
14 A1	..	198	193	165	160	60	60	53	53	43	43	38	38	23	47.1
14 A2	..	190	182	150	141	61	61	53	54	43	44	39	39	23	47.1
14 B	..	195	190	158	153	60	60	56	57	52	53	50	50	44.5	91.3
14 B1	..	200	200	130	130	122	121	115	112	108	105	102	100	83.1	172.4
14 B2	..	195	185	155	145	60	61	57	57	54	54	50	50	45.7	93.8
14 B3	..	195	177	140	127	62	61	58	56	55	53	51	51	45.7	93.8
15 A	..	197	191	165	159	60	59	52	51	43	41	38	38	22.2	45.5
15 A1	..	200	200	140	140	128	128	119	114	100	97	89	90	44.9	92.9
15 B	..	195	190	158	153	59	59	56	57	53	54	51	51	46	94.4
16 A	198	198	148	165	119	79	75	75	73	72	71	71	72	38	78.6
16 A1	193	193	186	156	144	115	115	112	112	107	109	104	105	55.4	115.5
16 B	195	195	168	162	130	80	78	78	76	75	74	74	73	39	80.7

Gage readings on cars, lb. per sq. in.

Test of														
	Rear of Car 5		Car 10		Car 12		Car 14		Car 16		Car 18			
1 A	..	18	..	5	..	*	..	*	..	*	..	*		
3 A	14	20	..	1	..	*	..	*	..	*	..	*		
3 B	31	34	..	5	..	*	..	*	..	*	..	*		
4 A	13	22	..	3	..	*	..	*	..	*	..	*		
4 B	26	36	..	3	..	*	..	*	..	*	..	*		
5 A	28	37	..	5	..	*	..	*	..	*	..	*		
	Car 3		Car 5		Car 7		Car 9							
7 A	..	27	..	14	..	*	..	*	..	..	..	..		
7 B	..	25	..	13	..	*	..	*						
8 A	..	26	..	12	..	*	..	*						
	At flow meter													
9 A	37	34												
9 B	30	30												
10 A	34	32												
10 B	30	29												
11 A	37	37												
11 B	34	33												
12 A	25	27												
12 B	30	30												
13 A	29	29												
13 B	38	35												
14 A	29	30												
14 A1	30	30												
14 A2	30	30												
14 B	37	37												
14 B1	79	78												
14 B2	38	38												
14 B3	38	38												
15 A	29	29												
15 A1	75	70												
15 B	38	38												
	At flow meter		Car 3		Car 5		Car 7		Car 10		Car 12		Car 13	
16 A	71	71	37	42	6	15	**	**	2	10	..	8	..	8
16 A1	100	102	58	67	21	32	**	**	..	15	..	9	..	8
16 B	70	69	39	45	7	17	**	**	..	10	..	8	..	8

*Steam, no pressure. **No readings.

Notes:

Boiler gage readings were taken before test started, at start of test, and at finish of test and recorded in this order in the three columns under Boiler Pressure.

Gage reading on Tests 1A, 7A, 7B, 8A, were taken immediately test was started, and at end of test. All other gage readings were taken two minutes after test started, and at end of test and recorded in these orders in the columns under their respective headings.

Duration of Tests Nos. 16 A, 16 A1, 16 B

Test	Time to get steam at end of 13th car	Time to raise pressure from 0 to 5 lb.	Time to raise pressure from 0 to 8 lb.
16 A	5m. 13s.	19m. 45s.	31m. 30s.
16 A1	4m. 57s.	8m. 0s.	9m. 15s.
16 B	6m. 16s.	16m. 30s.	21m. 8s.

as the location of recording instruments is shown in the drawing.

The capacity of the various combinations of locomotive apparatus was determined with a General Electric Company's Type T Flow Meter.

As shown on the diagram, the flow meter was located between the tender and first car, when the engine was coupled to the train, and when testing the engine alone, a piece of 2 in. pipe, 36 in. long, with standard 1½ in. by 2 in. end valve on one end and standard steam hose on the opposite end was coupled to the steam hose at the rear of the tender. The end valve was fully open during all tests, allowing steam to pass freely to atmosphere.

In case of the 18 and 9 car trains, all of the tests consisted simply of taking the time between the admission of steam to the head end of the train and its appearance at the different gage locations, as well as the hose coupling at the rear of the last car, the steam valves inside of the car being fully opened during this interval.

Table 1 is a tabulation of the details of each test and notes the class of equipment on the locomotive. The figures under "Equivalent Boiler Horse Power" represent the total power that would have been supplied for one hour, had the individual tests been continued for that length of time.

The table comprises the complete information in the hands of the committee, with the exception of the two-minute readings at each gage; these readings were, however, taken for checking purposes and the figures recorded in the table at the beginning and end of tests are taken from the detailed readings.

Chart 1 shows the pressure loss in pounds per square inch in the steam pipes and connections between engine and tender.

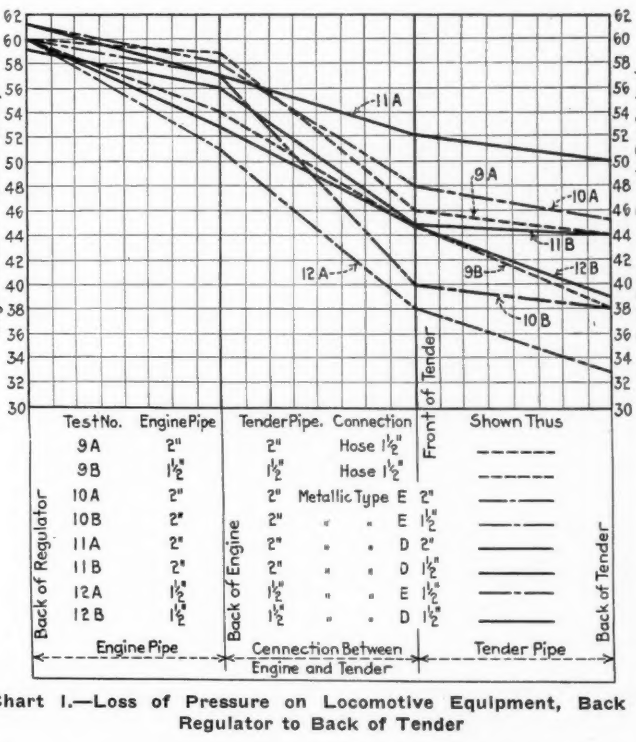


Chart I.—Loss of Pressure on Locomotive Equipment, Back of Regulator to Back of Tender

These tests were run with the same type of regulator, a 1½ in. by 1½ in. regulator being used for 1½ in. piping, and a 1½ in. by 2 in. regulator for the 2 in. piping. This sheet shows that with 2 in. piping and 2 in. connections, as in tests 10-A and 11-A, a steady pressure drop was experienced and a fairly constant flow of steam obtained. A similar result is obtained when 1½ in. piping and 1½ in. connections were used (see tests 9-B, 12-A and 12-B), the pressure drop, however, being far greater than in the previous named tests. When 2 in. piping was used, with 1½ in. con-

nections (see tests 9-A, 10-B and 11-B), the pressure drop in the 2 in. pipe was much less than in the 1½ in. connections, the resulting drop, however, being more than with 2 in. pipe throughout, but less than with 1½ in. pipe throughout.

Chart 2 shows the difference between the various type of connections, between engine and tender with various sizes of piping. It can readily be seen that 2 in. pipes on both engine and tender are more efficient than 1½ in. pipes, and that the

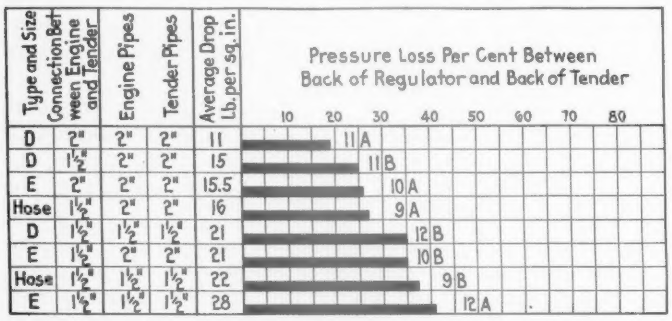


Chart II.—Pressure Losses and Locomotive with Various Sizes of Piping

ideal arrangement (as far as capacity is concerned and considering the equipment available at the test), is to have a 2 in. metallic connection such as the type D between engine and tender, the losses being far less with this combination than others noted. The 1½ in. hose and 1½ in. metallic connections between engine and tender compare favorably, the latter having a little advantage. The 1½ in. piping on engine and tender shows a great loss both in pressure and flow of steam and, therefore, cannot be recommended as good practice.

Chart 3 shows the relative efficiencies of the connections between engine and tender, the 2 in. metallic type D showing

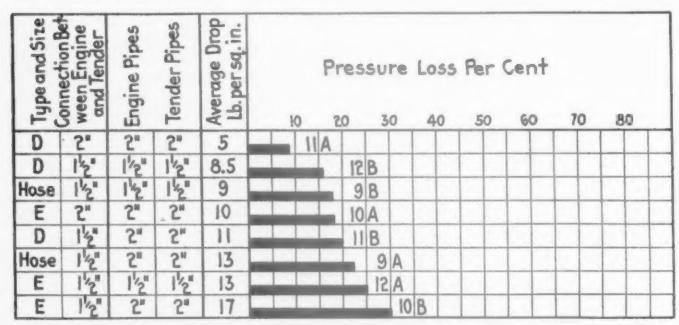


Chart III.—Pressure Loss in Connections Between Engine and Tender

about double the efficiency of the 1½ in. metallic of the same type.

Chart 4 shows the capacity of the locomotive equipment with various adjustments and sizes of regulators. It can be readily seen that the 1 in. by 1½ in. regulator at maximum capacity using 1½ in. engine and tender pipe, delivers only about 57½ per cent of the 1½ in. by 2 in. regulator, adjusted at 60 lb., using 2 in. engine and tender pipe. The 1½ in. by 1½ in. regulator at maximum capacity with 1½ in. piping, is about equal to the 1½ in. by 2 in. regulator, adjusted at 60 lb. The 2 in. pipe combination with 1½ in. by 2 in. regulator, adjusted at maximum capacity delivered steam equivalent to 172 boiler horse power or 4,986 lb. of water per hour.

Chart 5 covers Tests 16-A-1 and 16-B and shows the time consumed in forcing steam through the train, the pressure variations in the train line, as well as the time to accumulate pressure at the rear of the last car, and finally the pressure at the termination of the test when 8 lb. had been obtained at the rear car.

A distinguishing feature of the 16-A-1 and 16-B readings is that with 115 lb. adjustment of regulating valve, 55.4 lb. of steam per minute, or at the rate of 3,324 lb. per hour

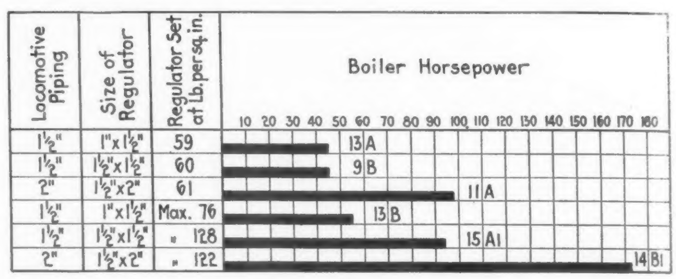


Chart IV.—Locomotive Equipment Capacities with Varying Adjustment of Regulators

passed into the steam train line and with 80 lb. adjustment, 39 lb. per minute, or 2,340 lb. per hour, which is only about 70½ per cent of the weight of the volume delivered with the higher regulating valve adjustment.

The committee feel that the A. R. A. committee's specification calling for an available supply of 3,200 lb. of steam per hour, for the exclusive use of the steam train line, might

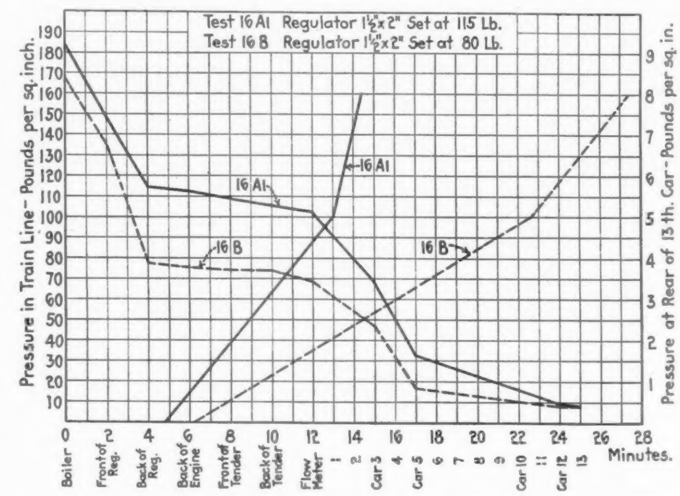


Chart V.—Pressure Drop in Train Line and Time to Obtain Pressure at Rear of 13 Cars. (Pressures at End of Test When 8 Lb. Obtained at Rear Car)

well be used by us as a basis in determining maximum requirements, in which case, if the quantity of steam specified per hour cannot be obtained with low reducing valve adjustment, then the adjustment must be increased to suit.

On the other hand, the disadvantages of carrying high steam train line pressure is, of course, thoroughly appreciated, and as a means of making a reduction possible, it is suggested that all known expedients be resorted to to insure that area of opening in all steam hose fittings, gaskets and end valves, be the equivalent of at least the opening of 1½ in. iron pipe or larger, thereby eliminating much of the friction now experienced.

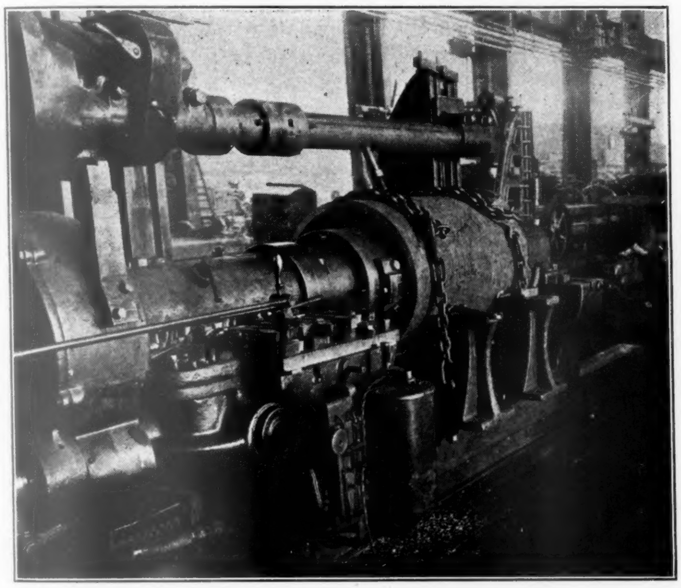
Melting Points of Metals	Deg. F.
Zinc	786.9
Lead	621.3
Aluminum (pure)	1,217.7
Silver	1,760.9
Iron, cast	1,920
Copper	1,981.4
Steel, mild	2,550
Nickel	2,646
Chromium	2,939
Vanadium	3,128
Tungsten	6,152

A Visit to a Prominent Mid-West Railroad Shop

The Stranger Finds in the Various Departments at Silvis Some Novel Methods of Facilitating Work

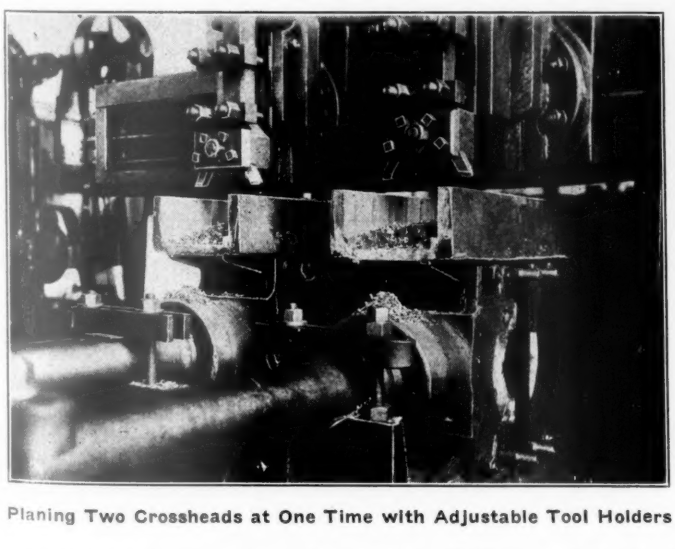
By S. W. MULLINIX
Superintendent Shops, Chicago, Rock Island & Pacific

THERE are many operations in locomotive repair work that are performed with similar equipment and similar methods in practically all shops. There are other jobs that are done in a variety of ways and every shop has some interesting ways of doing work and some devices made in the shop that are labor savers and money savers. Such things



Chains are Readily Adjusted and are Convenient for Holding Work

are always of interest to visitors and those who have developed improved methods usually bring them to the attention of strangers going through the shops. With this in mind, it



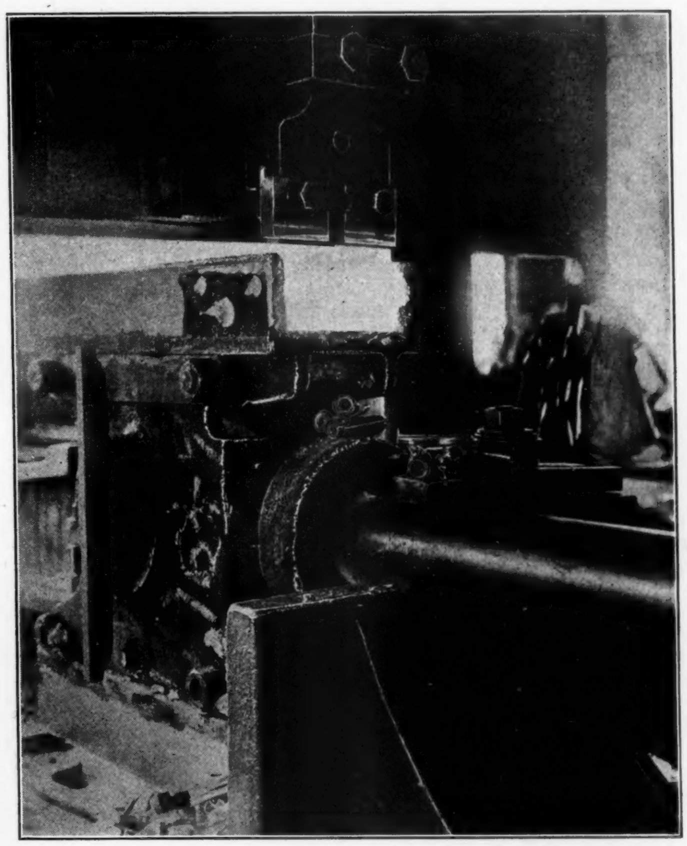
Planing Two Crossheads at One Time with Adjustable Tool Holders

may be of interest to readers of the *Railway Mechanical Engineer* to describe some of the things that the visitor sees when he comes to Silvis shops.

Let us assume that a party of men from other roads call at the office of the superintendent, whom they know, having met him at conventions. The superintendent takes it upon himself to show them through the plant, pointing out the things which in his mind would be most interesting to them.

On entering the machine shop the visitors are attracted by the number of boys operating machines; they ask if they are mechanics. The shop superintendent tells them no, but we are going to make mechanics out of them. We feel that any young man who starts in as an apprentice to learn a trade, if he behaves himself and has ordinary intelligence, is sure to advance; he cannot stand still, he must not go backward, so we must assist him in pushing forward.

When the party stopped at a cylinder boring machine, the operator was boring a cylinder bushing; it was held down



This Tool Has Reduced the Time of Planing Babbitted Crosshead Shoes by Half

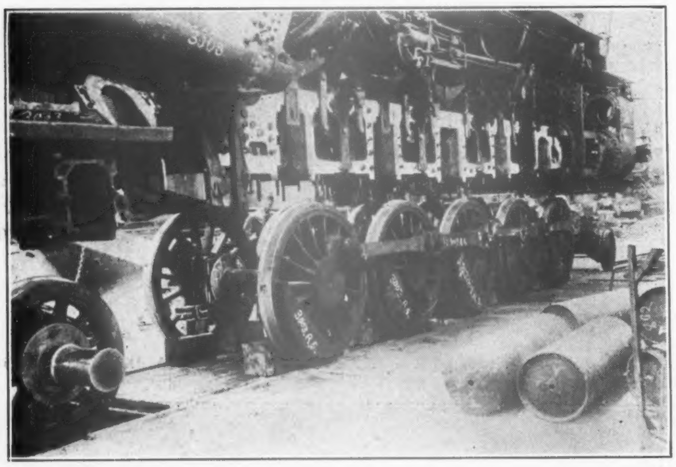
by chains instead of by the old method of anchoring, which consisted of bolts, clamps and blocks. By doing away with these, the cylinder can be set up in half the time. The use of chains for holding parts being machined is not confined to cylinder bushings alone, but any work where they could be substituted in place of the old method.

A little further on was a planer machining two crossheads at one time, using adjustable tool holders with four cutting tools instead of the old way using but one. The visitors quickly saw the advantage of this method and announced their intention of trying it in their own shops.

They next turned to a machine planing the guide fit of

crossheads which had been babbitted. The superintendent explained the advantage this tool had over the old single tool with which it took one hour to do the job; it is now done in half the time. At one time it was the practice to use jigs for babbitting crossheads and not machining, but the results are not so satisfactory. The tool is adjustable and can be set to any width of guide.

The visitors were then taken to the erecting shop where preparations were being made to wheel a locomotive. The



Time is Saved by Applying Side Rods and Putting Binders in Place Before Wheeling

superintendent explained the advantage in applying the side rods prior to wheeling, placing the binders on blocks under the driving boxes and wheeling the locomotive on the binders. The photograph shows this arrangement which saves many hours of hard work.

The party was very much interested in an electrically driven portable band saw that is used in fitting lagging to the boilers. This saw was built in the shop. Prior to the time it was built a common hand saw was used. A shop

Forging Heavy and Intricate Parts Saves Both Labor and Material

where a great deal of this work is done is not complete without one of these machines which can be built at a relatively small cost.

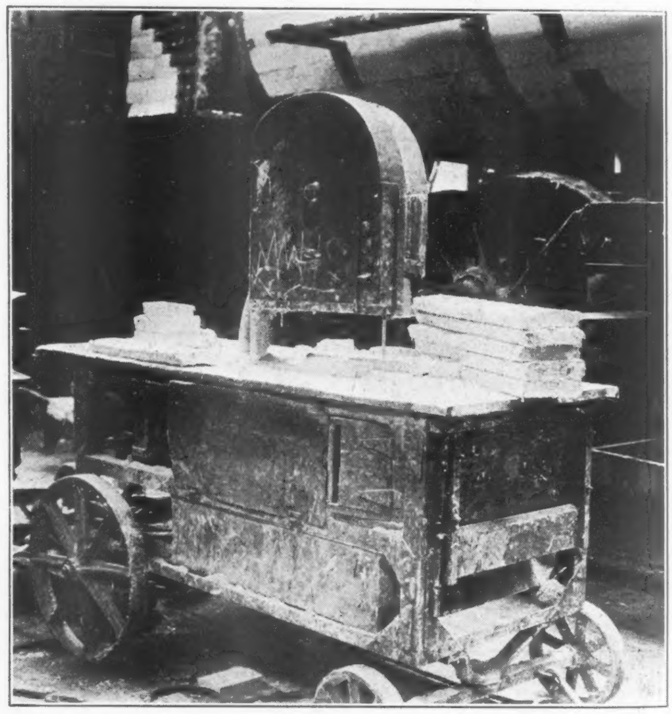
The party next went through the forge shop where they were shown the piles of scrap that had been delivered by the store department to be worked up into standard forgings, which, when finished, would be delivered to the store for distribution. They were interested to see a collection of the most intricate parts produced on the forging machines as exhibited on the rack shown in the illustration.

Passing to the boiler shop, the first thing pointed out was a locomotive back end complete, the mud ring being riveted in by a 150-ton bull riveter. This is one of a number of extra back ends carried in stock to facilitate the handling of locomotives through the shop.

The shop superintendent called attention to the method of bushing enlarged staybolt holes in wrapper sheets, by applying soft steel bushings, which are made in the forging machine at the rate of 200 per hour and threaded by machines at the rate of 110 per hour.

The visitors examined with interest a machine that was making crank pin washers out of $\frac{1}{2}$ in. scrap boiler plate. These parts are punched cold in two operations at the rate of 40 per hour. The special punch first punches out the center hole, $3\frac{1}{2}$ in. in diameter. The second operation is to punch the outside of $6\frac{1}{2}$ in. diameter.

They were shown the method of renewing door, side and tube sheets in fireboxes, without renewing any rivets in the



A Band Saw for Cutting Lagging is a Great Time Saver

mud ring by cutting the side and door sheets off above the first row of staybolts and tube sheets below the holes for the tubes. These sheets are welded in, no rivets being used whatever.

After a visit to the store department and the scrap dock, the party returned to the office. Before taking their departure, they thanked the superintendent for the interest he had taken in showing them through the plant and expressed a desire to come again and bring others whom they knew would be interested. He assured them that he was always glad to welcome not only railroad men, but the general public as well for he felt that no employee should neglect an opportunity to reach out for business, and the shop men wished the public to know that they are just as keen to get their patronage as those in other departments.

ABRASIVE PAPER AND CLOTH should never be stored in a damp place, as the glue absorbs moisture very quickly. This loosens the grain and causes it to rub off before it is dull.—*The Melting Pot.*

New Norfolk & Western 100-Ton Coal Cars

Tests to Determine Load on Springs Due to Irregular Track and Clearance for Curves

BY JOHN A. PILCHER
Mechanical Engineer, Norfolk & Western

(Continued from the May Issue)

A CAR body resting, as does this one, on four points of support, two on each truck, on rollers, allows for the vertical angling between the plane of the truck and plane of the car, in passing the sharp vertical curves of the tracks leading to the dumper. These four points of support also make it necessary that the car body be measurably flexible, in order that it may accommodate itself to the changes in the surface of the track, without undue stresses within itself, and without great differences in the load pressure on the four supporting points. This would not be possible with a closed top rigid car body. When such a rigid car body is used, a method of cross equalization on one end of the car must be introduced with a truck of this type.

Observations made on previously constructed large open-top cars, in connection with the adjustment of the side bearings, indicated there would be no difficulty in supporting such a car on four points. In fact, with the close adjustment of the side bearings, to prevent excessive rocking, the car body had, in a measure, to accommodate itself to the changes in the plane of the track, and has been doing this for a number of years without any apparent detriment.

Some experiments were conducted with the object of determining just to what extent such a car body could be warped out of its normal plane without detriment, and without excessive changes in the loading on the four points of support. The first experiment was on a flat-bottom gondola, and was made with both the light and loaded cars. Cars for the test were taken from the first group of 90-ton cars constructed, and known as Class GKa. Four groups of springs were prepared, of sufficient capacity to carry the loaded car body and accurately calibrated in a Riehle Testing Machine.

The car body was brought to a level plane, resting on the four groups of springs. The height of each group of springs was carefully measured and recorded. From previous calibration the corresponding loading in pounds was known. Liners of varying thickness were then placed under the car, on top of the spring at the diagonal corners, so as to bring the car body to a warped plane. The diagram in Fig. 1, with the accompanying table, gives the location of the groups of springs and tabulations showing the reading of the height of each spring and the corresponding load. In placing the liners of the thickness named in the table, two such were used, one each under opposite diagonal corners. The maximum warp in the car body for the light car was three inches

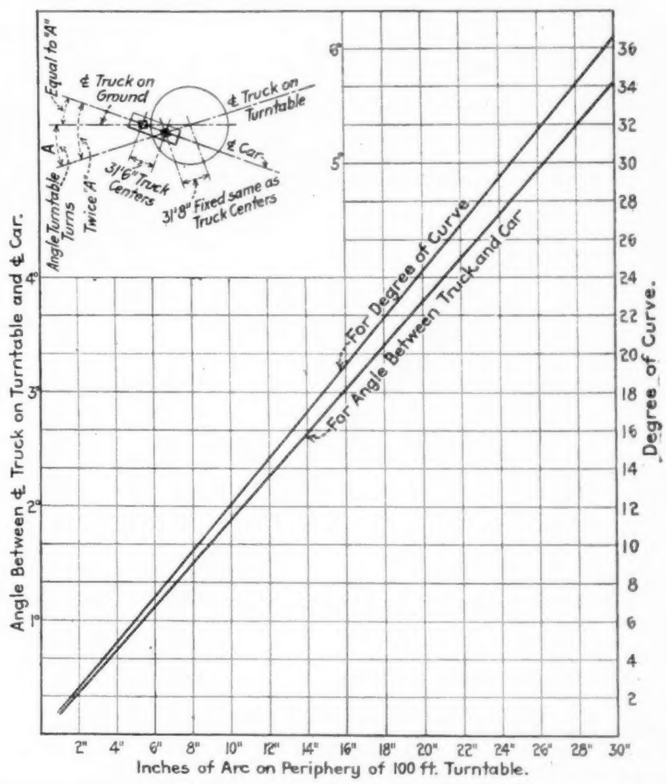
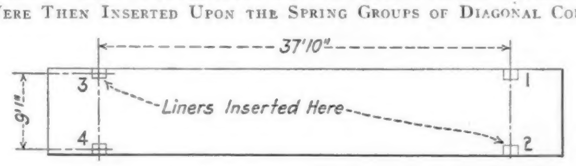


Chart for Determining Degree of Curve Over Which Car Will Pass

FIG. 1—TEST OF INEQUALITIES OF LOADS AT FOUR POINTS OF N. & W. 90-TON GONDOLA CARS, CLASS GKA, WITH DIFFERENT AMOUNTS OF WIND IN THE CAR BODY

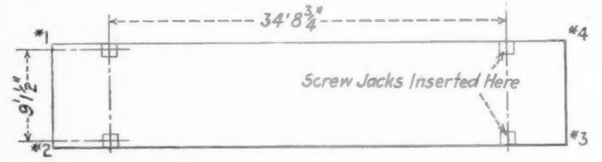
FIGURES WERE OBTAINED BY SETTING CAR BODIES UPON FOUR GROUPS OF CALIBRATED SPRINGS, LEVELED TO A COMMON PLANE AND LOCATED UNDER THE ENDS OF BODY BOLSTERS. LINERS WERE THEN INSERTED UPON THE SPRING GROUPS OF DIAGONAL CORNERS AND THE HEIGHT OF GROUPS TAKEN



Weight of car used in test	Thickness of liners, inches	Height of springs at points, inches: 1	2	3	4	Loads at the several points as deduced from the deflection of the springs, pounds: 1	2	3	4	Total, pounds
Car empty with liners under diagonal corners 2 and 5. Empty car body, weight 32,400 lb.; body and trucks, 59,800 lb.	None	11 53/64	11 53/64	11 51/64	11 52/64	7,330	7,857	8,666	8,571	32,424
	½	11 53/64	11 53/64	11 52/64	11 53/64	7,330	7,857	8,000	8,461	31,648
	¾	11 53/64	11 52/64	11 52/64	11 53/64	7,330	8,571	8,000	8,461	32,362
	1¼	11 52/64	11 52/64	11 51/64	11 53/64	8,000	8,571	8,666	8,461	33,698
	1½	11 54/64	11 52/64	11 51/64	11 53/64	6,666	8,571	8,666	8,461	32,364
Car loaded										
Loaded car body, weight of body and trucks, 237,100 lb. Body and lading, 209,700 lb.; body alone, 31,500 lb.	None	10 60/64	11 1/64	10 63/64	11 3/64	53,333	50,000	50,833	50,000	204,166
	½	11	11 2/64	10 58/64	11 4/64	50,000	49,167	55,000	49,167	203,334
	¾	11	10 61/64	10 58/64	11 4/64	50,000	53,333	55,000	49,167	207,500
	1¼	11 2/64	10 58/64	10 57/64	11 8/64	48,334	55,833	55,833	45,834	205,834
	¾	10 62/64	10 61/64	10 61/64	11 3/64	51,666	53,333	52,500	50,000	207,499
	½	10 61/64	10 63/64	10 61/64	11 2/64	52,500	51,666	52,500	50,833	207,499

off the plane of the other three points and on the loaded cars, 2½ in. It shows well for the accuracy of the measurements that the total loads, as shown from the spring readings, differ so little from the actual weight of the car body, both

Fig. 2—Test of Inequalities of Loads at Four Points of N. & W. 90-Ton Gondola Car No. 101214, With Different Amounts of Wind in the Car Body. Figures Were Obtained by Setting Car Body Upon Four Groups of Calibrated Springs, Leveled to a Common Plane and Located Under the Jacking Blocks at Car Corners. A Small Screw Jack Was Then Placed on the Springs at the Corner to Be Raised, the Corner Raised 0.5 In. at a Time Until a Total of 3.0 In. Was Reached and the Readings of the Various Groups of Springs Taken

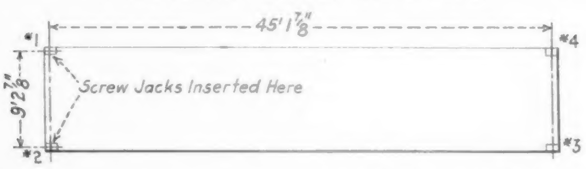


Heights corners were raised, inches	Height of springs at points, inches				Loads at the several points as deduced from the deflection of the springs, pounds				Total, pounds
	1	2	3	4	1	2	3	4	
	With Corner No. 4 Raised								
.0.....	12.945	12.795	12.90	12.83	7,600	8,225	7,880	8,480	32,185
0.5.....	12.975	12.775	12.92	12.805	7,425	8,330	7,770	8,625	32,150
1.0.....	13.00	12.745	12.95	12.785	7,290	8,525	7,600	8,780	32,145
1.5.....	13.025	12.72	12.97	12.76	7,125	8,675	7,490	8,880	32,170
2.0.....	13.055	12.70	12.99	12.735	6,990	8,800	7,375	9,025	32,190
2.5.....	13.08	12.67	13.02	12.71	6,780	8,990	7,180	9,180	32,130
3.0.....	13.11	12.645	13.04	12.685	6,590	9,140	7,070	9,340	32,140
	With Corner No. 3 Raised								
.0.....	12.95	12.80	12.91	12.82	7,570	8,180	7,830	8,530	32,110
0.5.....	12.92	12.82	12.88	12.84	7,740	8,070	8,000	8,425	32,235
1.0.....	12.89	12.85	12.86	12.87	7,920	7,890	8,120	8,260	32,190
1.5.....	12.86	12.88	12.83	12.89	8,085	7,720	8,275	8,130	32,210
2.0.....	12.83	12.92	12.81	12.92	8,270	7,470	8,390	7,970	32,100
2.5.....	12.80	12.95	12.79	12.94	8,430	7,300	8,510	7,850	32,090
3.0.....	12.77	12.97	12.77	12.96	8,610	7,180	8,620	7,720	32,130

Class of Car Used in Test—90-Ton N. & W., Gondola Car No. 101214, Light Weight 58,200 lb. Winding Test Results With First Corner 4 Raised, Then Corner 3

light and loaded. The figures, however, show for the light car a difference between the ends, represented by the numbers 1 and 2, and also the numbers 3 and 4, which does not exist. It is easily understood that the stiff, strong springs needed

Fig. 3—Test of Inequalities of Loads at Four Points of N. & W. 90-Ton Hopper Car No. 70564, With Different Amounts of Wind in the Car Body. Figures Were Obtained by Setting Car Bodies Upon Four Groups of Calibrated Springs, Leveled to a Common Plane and Located Under the Jacking Blocks of Car Corners. A Small Screw Jack Was Then Placed on the Springs at the Corner to Be Raised, the Corner Raised 0.5 In. at a Time Until a Total of 3 In. Was Reached and the Readings of the Various Groups of Springs Taken



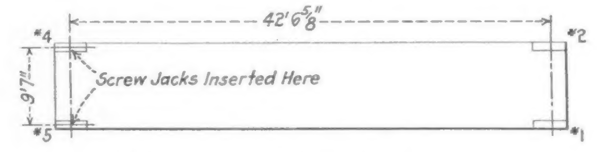
Heights corners were raised, inches	Height of springs at points, inches				Loads at the several points as deduced from the deflection of the springs, pounds				Total, pounds
	1	2	3	4	1	2	3	4	
	Hopper No. 70564, With Corner No. 2 Raised								
.0	12.74	12.935	12.705	12.925	8,780	7,375	9,025	7,940	33,120
0.5	12.76	12.915	12.73	12.90	8,630	7,500	8,860	8,080	33,070
1.0	12.80	12.88	12.765	12.86	8.430	7.720	8.640	8.315	33,105
1.5	12.82	12.86	12.795	12.835	8,320	7,850	8,475	8,450	33.095
2.0	12.85	12.83	12.83	12.81	8,150	8,010	8,275	8.600	33,035
2.5	12.87	12.81	12.845	12.78	8,030	8,160	8,190	8,770	33,150
3.0	12.885	12.79	12.87	12.75	7,940	8,250	8,060	8,930	33,180
	With Corner No. 1 Raised								
.0	12.72	12.965	12.70	12.94	8,920	7,220	9,050	7,860	33,050
0.5	12.69	12.99	12.67	12.96	9,100	7,060	9,250	7,740	33,150
1.0	12.66	13.02	12.64	12.99	9,300	6,875	9,450	7,570	33,195
1.5	12.63	13.04	12.605	13.02	9,490	6,700	9,675	7,375	33,240
2.0	12.60	13.07	12.575	13.06	9,690	6,550	9,875	7,120	33,235
2.5	12.58	13.10	12.55	13.09	9,725	6,360	10,040	6,925	33,050
3.0	12.55	13.12	12.53	13.12	10,020	6,230	10,170	6,730	33,150

Class of Car Used in Test—90-Ton N. & W. Hopper Car No. 70564, Light Weight 60,000 lb. Winding Test Results With Corners Nos. 1 and 2 Raised

for use under the loaded car will not deflect much under the empty car. This accounts for this discrepancy.

The diagram and tabulations, Fig. 2, show the results of a test on a similar type of car, light, using springs of a capacity to suit the light car. The tabulations show some differences in the loadings, but when corner 3 is raised three inches, the difference, minimum to maximum, is not much more than when the car was level. The tabulations for the

Fig. 4—Test of Inequalities of Loads at Four Points of N. & W. 100-Ton Gondola Car No. 101750, With Different Amounts of Wind in the Car Body. Figures Were Obtained by Setting Car Body Upon Four Groups of Calibrated Springs, Leveled to a Common Plane and Located Under the Jacking Blocks at Car Corners. A Small Screw Jack Was Then Placed on the Springs at the Corner to Be Raised, the Corner Raised 0.5 In. at a Time Until a Total of 6 In. Was Reached and the Readings of the Various Groups of Springs Taken



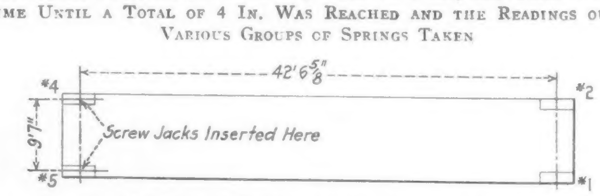
Readings With Jack Under Corner No. 5

Heights corners were raised, inches	Height of springs at points				Loads at the several points as deduced from the deflection of springs				Total, pounds
	Spring No. 1		Spring No. 2		Spring No. 4		Spring No. 5		
	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	
.0	12.820	8,325	13.090	6,420	12.885	8,170	13.095	6,725	29,640
0.5	12.860	8,080	13.050	6,680	12.900	8,080	13.060	6,945	29,785
1.0	12.875	8,000	13.020	6,840	12.935	7,880	13.035	7,100	29,820
1.5	12.900	7,860	12.990	7,065	12.960	7,740	13.000	7,320	29,985
2.0	12.935	7,660	12.950	7,305	12.995	7,530	12.985	7,400	29,895
2.5	12.950	7.575	12.945	7,330	13.005	7,480	12.960	7,545	29,930
3.0	12.970	7,460	12.905	7,575	13.030	7,315	12.935	7,680	30,030
3.5	13.000	7,280	12.875	7,745	13.060	7,120	12.910	7,830	29,975
4.0	13.030	7,100	12.855	7,870	13.085	6,960	12.890	7,940	29,870
4.5	13.050	6,975	12.835	7,980	13.110	6,800	12.865	8,080	29,835
5.0	13.080	6,780	12.805	8,160	13.130	6,665	12.845	8,190	29,795
5.5	13.100	6,660	12.780	8,310	13.150	6,545	12.825	8,300	29,815
6.0	13.125	6,500	12.755	8,960	13.170	6,415	12.815	8,365	30,240

Car Class GS. No. 101750. Weight of Body, 30,040 Lb. Trucks, 24,460 Lb. Total Weight, 54,500 Lb.

loaded car test, Fig. 1, show a difference, minimum to maximum loading, of 3,333 lb. when level. The difference, minimum to maximum, under the greatest wind given; viz., 2½ inches, is 9,999 lb., or less than 20 per cent of the load on one point. The maximum change of load at any one point during the test was 5,834 lb.; a little more than 10 per cent

Fig. 5—Test of Inequalities of Loads at Four Points of N. & W. 100-Ton Gondola Car No. 101750, with Different Amounts of Wind in the Car Body. Figures Were Obtained by Setting Car Body Upon Four Groups of Calibrated Springs, Leveled to a Common Plane and Located Under the Jacking Blocks at Car Corners. A Small Screw Jack Was Then Placed on the Springs at the Corner to Be Raised. The Corner Raised Was First Raised to .5 In., Then to 1 In., and Then 1 In. at Time Until a Total of 4 In. Was Reached and the Readings of the Various Groups of Springs Taken



Readings With Jack Under Corner No. 4

Heights corners were raised, inches	Height of springs at points				Loads at the several points as deduced from the deflection of springs				Total, pounds
	Spring No. 1		Spring No. 2		Spring No. 4		Spring No. 5		
	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	
.0	12.755	8,575	13.130	6,165	12.840	8,430	13.135	6,540	29,710
0.5	12.750	8,715	13.135	6,130	12.800	8,650	13.150	6,380	29,875
1.0	12.715	8,945	13.160	5,975	12.776	8,790	13.180	6,190	29,900
2.0	12.606	9,690	13.215	5,625	12.725	9,080	13.230	5,880	30.275
3.0	12.595	9,725	13.270	5,265	12.685	9,330	13.275	5,610	29,930
4.0	12.500	10,340	13.335	4,845	12.625	9,690	13.340	5,180	30,055

Car Class GS. No. 101750. Weight of Body, 30,040 Lb; Weight of Trucks, 24,460 Lb. Total Light Weight, 54,500 Lb.

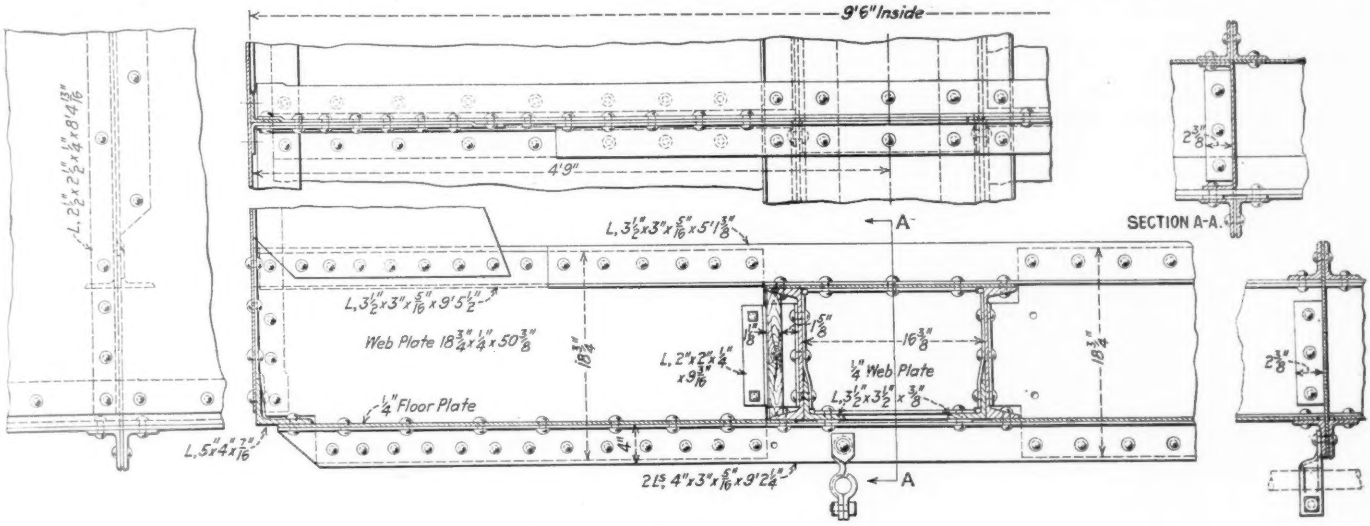
Note—The test could not be finished on this corner, as the car began to creep due to the wind. A stiff breeze was blowing against this side.

of the load on any one point. Two and one-half inches wind in a car, measured at the points shown, represents much more than will take care of any normal wind in the plane of the track.

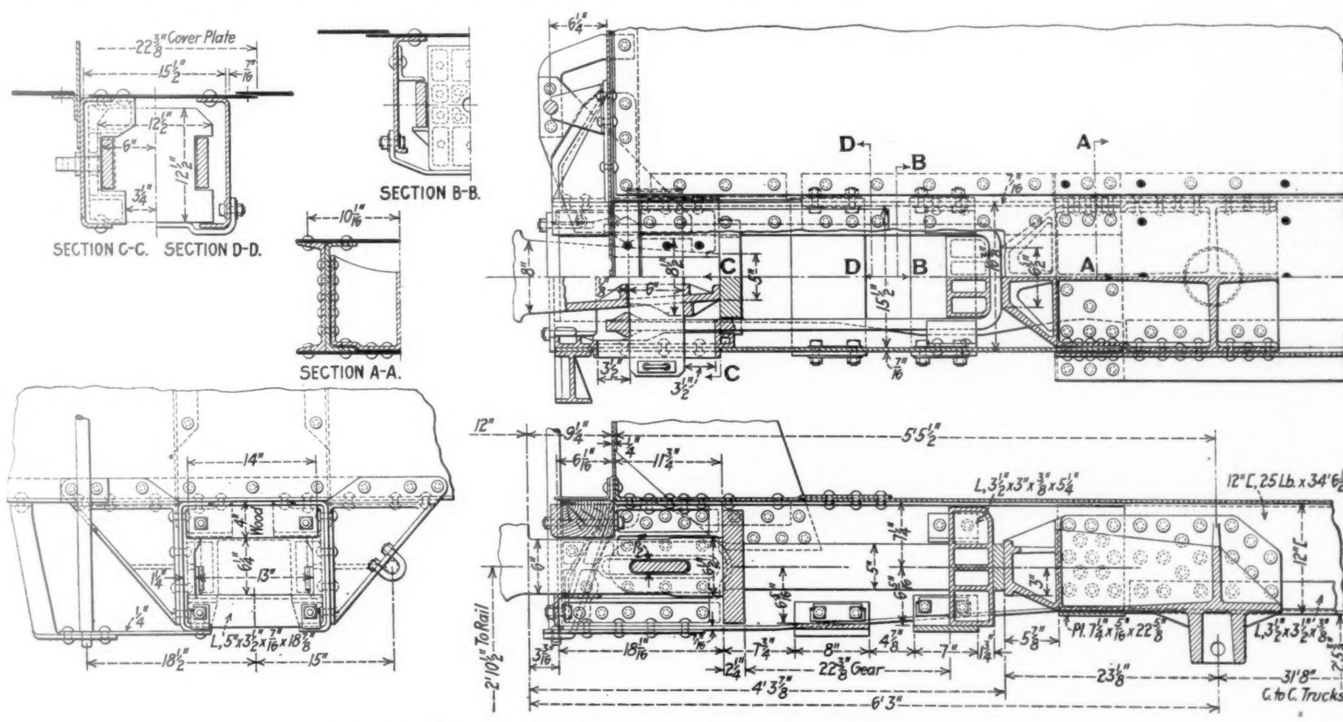
A second and similar test was made on the light body of a 100-ton hopper car. Fig. 3 shows the relative location of the groups of springs with their measured heights and corresponding calibrated loads. In this test the observation of the change in level of the corner raised was taken with a surveyor's level, mounted at a suitable point for observation. First one corner was raised three inches, and then another at the same end of the car. Close observation of these readings led to the belief that this car body was erected with about 1½ or 2 in. warp out of the true plane. The readings are more uniform with the warp when corner No. 2 is raised than under any other condition. The readings indicate that the car is forced much farther from its original form when raising corner No. 1 three inches out of plane than when raising corner No. 2.

With the completion of the first new side-bearing supported car, an additional series of winding tests was conducted. Those shown in the table, Fig. 4, were made by lifting the corner marked 5; those shown in Fig. 5, by lifting the corner marked 4. These results are interesting, in that they show conclusively that this particular car was built with an initial warp or wind in the body of about 2½ or 3 in. This accounts for the wide differences shown in the loading on the four corners when the wind was put in the car by lifting corner No. 4 four inches out of the normal, which must have been 6½ or 7 in. distortion from the position in which the car body was riveted. This observation led to cautioning the builders to be careful in setting up the car for riveting together.

Further observations were made of the warping of the car when mounted on its own trucks. Fig. 6 gives the diagram and tabular figures showing the method and results of observations on both a loaded and empty car. An inspection of the photograph of the truck shows there are two groups of



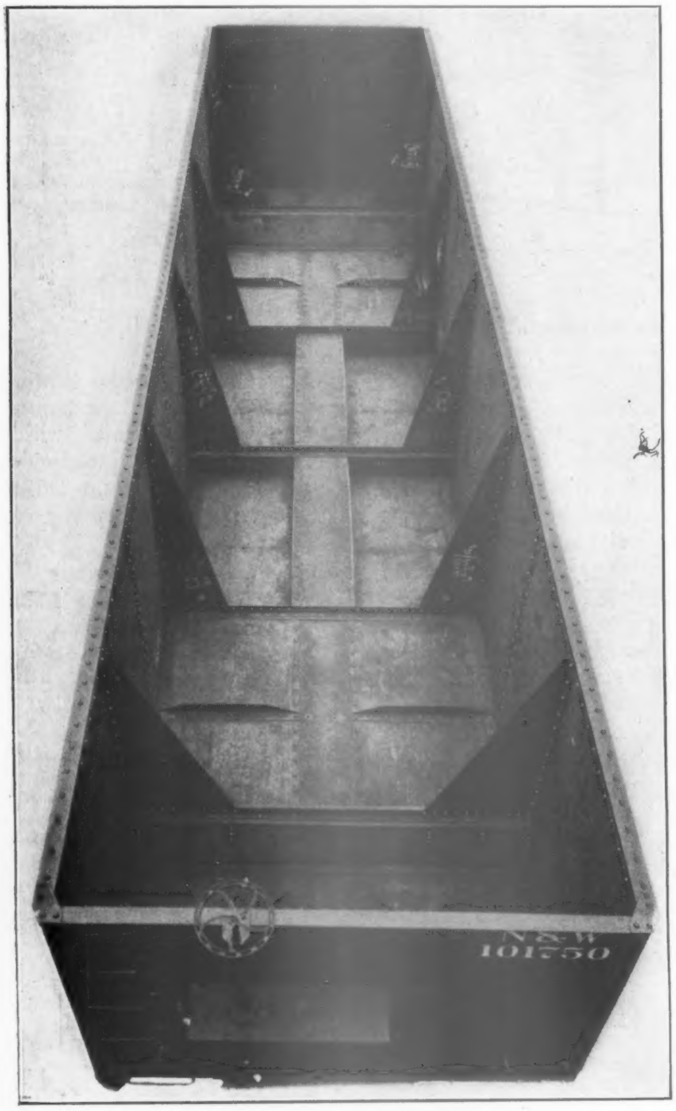
Details of the Center Diaphragm



Arrangement of Draft Gear With Farlow One-Key Draft Attachment

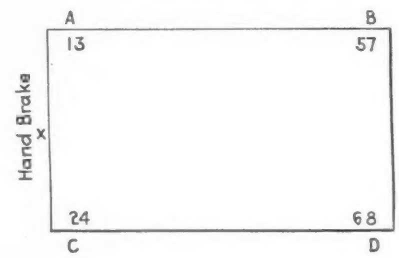
springs on each side of each truck. Remembering this the tabular figures in connection with the accompanying diagram can be readily understood. The readings in the columns are the heights of the different groups of springs, as measured. The measuring points on the truck did not admit of closer refinement in making the measurements. The results bear out the previous tests for winding on the car body, and show conclusively that an open-top car of this character can be carried on four points of support and conform itself to the changing plane of the track without undue stress and without marked change in relative loading on the four points. About 400 of these cars are now in regular service, and nothing has developed to indicate other than the deductions given above.

Before the first car was delivered for regular service, it was tested for clearance between the truck and car in curving up to curves of 35 degrees, using for this purpose a conveniently located turntable. One truck was placed in a fixed position on the turntable, with the other truck moving along the track as the table was turned to the extreme point the clearances between the truck and car would allow. By using the diagram, Fig. 9, and reading the movement of the turntable in inches at its circumference, the angular difference between car and truck, and corresponding curvature in track over which car could run without fouling, was readily determined.



Interior of the Car Body

FIG. 6—SPRING DEFLECTIONS OF SAMPLE 100-TON CAR, N. & W. 101750, THE RESULT OF ELEVATING THE TRUCK WHEELS AT DIFFERENT CORNER POSITIONS OF THE CAR



Elevation of truck wheel out of normal plane	Spring heights in each nest (inches): A		D		C		B	
	1	3	6	8	2	4	5	7
Empty Car Observed September 8, 1920								
Trucks in same plane....	$8\frac{1}{8}$	$8\frac{1}{8}$	$8\frac{1}{16}$	$8\frac{1}{8}$	$8\frac{3}{16}$	$8\frac{3}{16}$	8	$8\frac{1}{16}$
C ½ in. high; B ½ in. high; total 1 in........	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{1}{8}$	$8\frac{3}{16}$	$8\frac{1}{8}$	$8\frac{3}{16}$	$7\frac{15}{16}$	8
C 1 in. high; B 1 in. high; total ? in.............	$8\frac{5}{16}$	$8\frac{3}{8}$	$8\frac{7}{16}$	$8\frac{1}{2}$	$8\frac{1}{16}$	$8\frac{1}{8}$	$7\frac{7}{8}$	8
A ½ in. high; D 1½ in. high; total 2 in.......	8	$8\frac{1}{16}$	8	8	$8\frac{1}{4}$	$8\frac{1}{4}$	8	$8\frac{3}{16}$
A 1 in. high; D 2 in. high; total 3 in.......	8	8	$7\frac{15}{16}$	8	$8\frac{1}{4}$	$8\frac{5}{16}$	$8\frac{3}{16}$	$8\frac{1}{4}$
A 1½ in. high; D 2½ in. high; total 4 in.......	8	8	$7\frac{15}{16}$	8	$8\frac{1}{2}$	$8\frac{7}{16}$	$8\frac{5}{16}$	$8\frac{7}{16}$
D 1 in. high; total 1 in..	$8\frac{1}{16}$	$8\frac{1}{8}$	$8\frac{1}{16}$	$8\frac{1}{16}$	$8\frac{1}{8}$	$8\frac{3}{16}$	8	$8\frac{1}{16}$
Loaded Car Observed September 23, 1920								
A 1 in. high; total 1 in..	$7\frac{7}{16}$	$7\frac{7}{16}$	$7\frac{3}{32}$	$7\frac{9}{32}$	$7\frac{1}{4}$	$7\frac{1}{4}$	$7\frac{3}{32}$	$7\frac{7}{32}$
C 1 in. high; total 1 in..	$7\frac{5}{8}$	$7\frac{1}{2}$	$7\frac{1}{4}$	$7\frac{9}{16}$	$7\frac{1}{4}$	$7\frac{1}{4}$	$7\frac{1}{16}$	$7\frac{1}{8}$
A 3 in. high; total 3 in..	$7\frac{5}{16}$	$7\frac{5}{16}$	$6\frac{13}{16}$	$7\frac{1}{16}$	$7\frac{1}{2}$	$7\frac{7}{16}$	$7\frac{3}{8}$	$7\frac{11}{32}$
A 2 in. high; total 2 in..	$7\frac{3}{8}$	$7\frac{13}{32}$	$6\frac{25}{32}$	$7\frac{3}{16}$	$7\frac{7}{16}$	$7\frac{13}{32}$	$7\frac{1}{4}$	$7\frac{5}{16}$

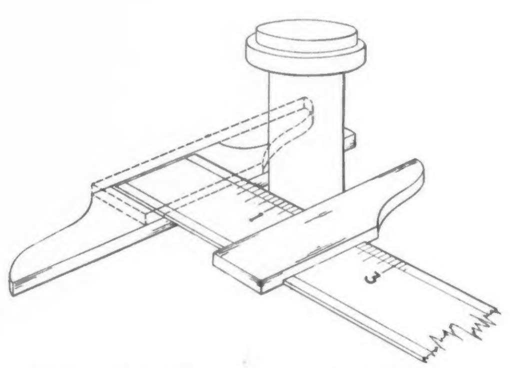
Note—In the loaded car results, the car was turned around but the same numbers and letters referred to are the same spring nests and corners as in the empty car test, as shown in the diagram.

A T-Square Attachment

BY C. NYE

A convenient attachment for T-squares is shown in the illustration. It consists of a sliding jaw, made of hard wood to the shape shown, and provided with a groove on the under side so that it slides freely but without vertical play on the T-square blade.

The use of this attachment is plainly indicated and it saves considerable time in measuring the diameters of models or small machine parts which are to be drawn. Graduations on the T-square blade are provided as small as desired and for any length. When not in use this attachment may be slid out of the way to the position indicated by the dotted lines, or removed altogether.



Drawing Facilitated by T-Square Attachment

FOR LAPPING HARDENED STEEL ordinary flour emery often leaves scratches caused by impurities. For the best results washed emery, such as opticians use, should be employed. Keep in a covered receptacle to exclude all dust.—*Abrasive Industry.*

Widening the Outlook of the Local Car Foreman*

Giving Supervisors At Outlying Points An Appreciation of the Business Aspect of Their Jobs

By L. K. SILLCOX

General Superintendent of Motive Power, Chicago, Milwaukee & St. Paul

If we were to take a map of the United States and endeavor to arrive at the number of car foremen scattered throughout this vast expanse of territory, we would be quickly impressed with the fact that many isolated points, far removed from large centers of population, have residing in their midst a local car foreman. The training which men receive in having charge of small outlying stations is probably the very best, if proper advantage is taken by them to make the most of their experiences and opportunities when so employed.

A man thus situated must of necessity be tremendously resourceful. He must know how to get along with the various officers and with his own men, working as one of them but, nevertheless, commanding their confidence and respect, besides being certain to deliver good service with little at hand to help. I wonder if we really take enough interest in these men, so as to give them encouragement to work for the future, and at the same time endeavor to regulate their training so that they can, without embarrassment to themselves, be prepared to take on added responsibilities.

It is unnecessary to enumerate the various duties required of these men, except to say that shifts are twenty-four hours long, seven days a week. Conditions govern a great deal in that some points are located at intersections with other roads and a complete working knowledge of interchange rules is vital; other stations are fitted up with slight wood and iron working facilities, etc., while occasional points have a wrecking outfit, and others handle both passenger and freight cars. Besides these obvious differences between various stations, we find a still greater divergence in the ability of various men to handle their work successfully, and while this is largely affected by reason of the personal ability of individuals, nevertheless if proper selection has been made in the first place, it is reasonable to believe that with adequate training and loyal support, most men should, through their own ambition as well as the assistance given by the higher supervisors, be in a position to advance and increase their responsibilities, both to their own business advantage and that of the railroad they serve.

Acting along this line, I am taking the liberty to bring to your notice a few items, appealing to me from personal experience, which would tend to round out a foreman's cycle of duty and make it possible for him to check honestly and impartially his own operations, and justify in his own mind whether progress has been experienced periodically. With labor and material so high, we must of course give careful study to the business side of the service so as to be sure that we can justify every expenditure made. No one is in a better position to do this than the local man who is actually employing the men to do the work and the material required for its completion; therefore, a study of the figures should be kept daily and measured against the output and actual service rendered to the railroad in facilitating the handling of transportation, which is the only commodity that any railroad has to sell.

Form 1795

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY CO.

Distribution of Pay Roll for Month of__________192__

Station__________ Foreman__________

FIRST HALF

Telegraph Symbol	A	B	C	D	E	F	G	H	K	L	M	N	O	P	Q	R	S	T	U
Date	Freight Car Repairs	Passenger Car Repairs	Work Car Repairs	Shop Machinery Repairs	Passenger Car Retirements	Freight Car Retirements	Work Car Retirements	Locomotive Repairs	Locomotive Retirements	Dispatchers and Hostlers	Motor Car Repairs	Shop Orders	Coal Chutes	Transportation Expenses	All Other Expenses	Total	MAN HOURS Straight Time	Overtime	Total
1																			
2																			
3																			
13																			
14																			
15																			
Monthly Rated Employes																			
Total First Half																			
SECOND HALF																			
16																			
17																			
18																			
30																			
31																			
Monthly Rated Employes																			
Total Second Half																			
Grand Total for Month																			

Fig. 1—Form for Monthly Payroll Distribution Made Out at Each Repair Point

Payrolls

Regardless of whether a definite appropriation is given each month with which to operate a station, the local foreman ought, for his own benefit, to keep accurate record and separation of accounts so that he may be correctly informed daily and also measure the expense against the trend of business. Form 1795, which is used to very great advantage for this purpose, is shown in Fig. 1.

It is interesting to note from time to time just what ratio of overtime hours are expended relative to straight time man hours. The form shown in Fig. 2 is used for that purpose.

Inspection

The cost of inspection per car handled ought to be an index of yard service and any car foreman having to do with

* Abstract of a paper presented before the Car Foremen's Association of Chicago, April 11, 1921.

operating officers will assist himself greatly through the keeping of a statement somewhat as suggested below:

COST OF TRAIN YARD INSPECTION

Date	No. of Cars Handled Through Yard	Total Labor	Cost Per Car

In addition to this, it is well to know exactly the time required to handle each train so that no question of delay may arise which cannot be accurately checked; it should also be established just what men were responsible for the particular work done on the equipment. Besides, a system can be arranged for whereby train crews will report the difficulty which they may have had with cars before arrival at destination. This can most easily be followed up by using the inspection form shown in Fig. 3.

Repairs

Care should be employed to see that no cars are switched to repair tracks which can be handled in train yards under blue flag protection. In order to avoid delay to equipment as well as further damage on this account and the cost of switching, it is generally a good plan for the man in charge to cover his entire point, including train yards, repair tracks, loading and industry platforms, interchange stations, etc.,

(Form 1900)

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY CO.

STATEMENT OF DAILY FORCE AND OVERTIME

Department

Location

Gang

Day and Date for which report is made

A Authorized Force (No. of Men) B Authorized Amt. of Payroll

C Number Men Worked D Actual Amt. of Payroll

E Explanation of Excess Force

F Kind of Work Performed

G Overtime Specifically Authorized (Hours) 1st Prorata ... 2nd Penalty ... H Amount 1st Prorata ... 2nd Penalty ...

I Unauthorized Overtime Worked (Hours) 1st Prorata ... 2nd Penalty ... J Amount 1st Prorata ... 2nd Penalty ...

K Explain Unauthorized Overtime in Detail on Back of Form

DEFINITION:—
Prorata overtime is overtime for which payment is made at regular rates
Penalty overtime is overtime for which payment is made at rate in excess of regular rates
"Overtime Specifically Authorized": Overtime authorized by head of department for some specific purpose

Foreman
(Personal Signature Required)

Instructions:
On reverse side must be shown **complete** explanation of all unauthorized overtime worked and reason therefor must be adequate
Report must be made daily for preceding day by timekeeper, and where no timekeeper, by foreman
Report to be made in triplicate: one copy to be retained by foreman for his record, two copies to be sent by foreman to his superior, who will check carefully, initial and forward one copy to head of department with explanation of action taken with reference to unauthorized overtime or excess force worked

Fig. 2—Form Used to Keep a Daily Check on Overtime. In a Year Overtime was Reduced From 16 Per Cent to 6 Per Cent of the Total Payroll

each morning or periodically each day so that a systematic method of procedure can be followed out.

Set Outs and Break In Twos

Train movements are more or less delayed by reason of the setting out of cars, mostly for defects such as hot boxes, break beams down, couplers dropped out, etc. In certain localities very few such cases occur, while in other, and perhaps adjoining territories, the number of such embarrassments is large, a condition which cannot be justified under any circumstances. There seems to be a reason for differences of this sort in service and there is no question but that there will be an occasional failure which could not have been prevented. These, however, are rare when cars are given proper inspection before being allowed to proceed on the line. In order to keep a suitable record, tabulations are maintained as indicated on the forms shown herewith. One is a record of draw bar failures and the other that of hot boxes encountered between terminals.

If local men watch such reports closely and take action in connection with cars which, having left their terminal,

F 8-20 100M Form 875

OUTBOUND — Inspection started ... Inspection completed ... Side of Train when Facing the Engine — Inspector's Initials, R. H. ... Inspector's Initials, L. H. ...

Chicago, Milwaukee & St. Paul R'y Co.

JOINT REPORT OF CONDITION OF TRAIN

______ Division

INBOUND — Inspection started ... Inspection completed ... Side of Train when Facing the Engine — Inspector's Initials, R. H. ... Inspector's Initials, L. H. ...

Train No. ... Leaving ... No. of Cars ... No. of Brakes Cut Out ... Date ... 192

Train No. ... Arriving at ... No. of Cars ... No. of Brakes Cut Out ... Date ... 192

Engine No. ... Engineer ... Conductor ... Car Inspector for Outbound Movement ...

Car Inspector for Inbound Movement ...

MATERIAL USED ENROUTE

Initial	Car No.	Material Used	No.	Size or Kind	A or B End	New or Sec Hand	Why Removed	How Disposed of

FLAT WHEELS

Initial	Car No.	Kind of Car	Taken At	Left At	First Noticed

HOT BOXES

Initial	Car No.	Loaded or Empty	Weight of Load	Marked Capacity	Taken At	Left At	No. of Hot Boxes

GIVE INFORMATION OF ANY DEFECT AFFECTING SAFETY OR COMFORT OF PASSENGERS OR EMPLOYES

Initial	Car No.	Defects

NOTE: This form to be considered part of the equipment of all trains. Car inspectors will hand two copies of the blank to outbound train conductors and will also pick them up from conductors at termination of runs. Inspectors will enter the time when the inspection of train began and was completed at initial and final terminals and the number of brakes cut out at initial terminals. Conductors will fill out remainder of blank as required. Inspectors at final terminals will endorse the reports to show repairs made, and forward one copy to the Division Superintendent, retaining the other copy for file.

Fig. 3—An Inspection Report Which Clearly Defines the Responsibility of Train Service and Car Department Employees for Condition of Equipment in Trains

are set out on account of mechanical defects and make a thorough investigation with a view of correcting the difficulty and preventing a recurrence, much good to the service will

RECORD OF DRAWBAR FAILURES BETWEEN TERMINALS AND COMPARISON OF RANKING OF ENGINEERS AS TO CAR MILES PER FAILURE

PERIOD—ONE MONTH

Territory—One Operating Division

Comparison to be made upon Drawbar Failure per car miles accumulated on the Division for one month.

Rank	Engineer's Name	Draw Bar Failures	Number of Cars Hauled	Total Car Miles Per Engineer	Car Miles Per Draw Bar Failure
Totals......					

RECORD OF CARS SET OUT ON ACCOUNT OF HOT BOXES BETWEEN TERMINALS AND COMPARISON OF RANKING OF CONDUCTORS PER CAR SET OUT

PERIOD—ONE MONTH

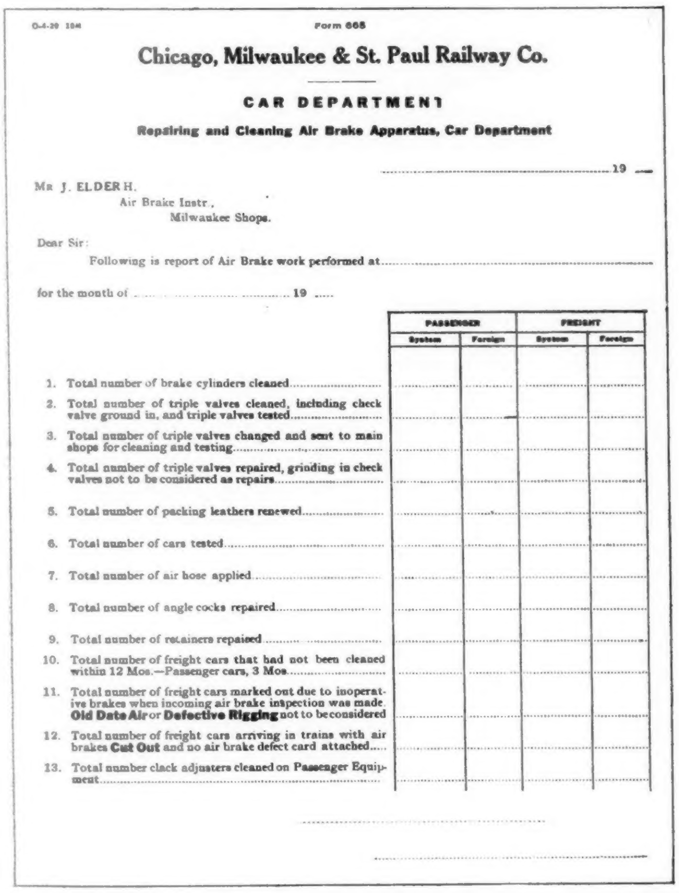
Territory—One Operating Division

Rank	Conductor's Name	Car Set Out Acct. of Hot Box	Number of Cars Hauled	Car Miles Per Conductor	Car Miles Per Hot Box Set Out
Totals......					

be experienced. Any foreman, who will not take the trouble to see these reports and is not close to his train yard organization, is bound to give poor service to the transportation department. It should not be taken for granted that it is impossible to run a train without setting out a bad order or

two or without having a wreck once in a while, and a great deal of this difficulty can be saved by giving equipment more careful inspection before trains leave terminal yards.

In order to safeguard the service a careful outbound inspection ought to be insisted on and repairs made where necessary. It seems needless to refer to just what should be done in order to guarantee proper protection, aside from mentioning that brake rigging, trucks, and draft gear should be carefully gone over. Cars showing signs of derailment or rough handling should be critically examined. Lost cotter keys ought to be replaced in order to safeguard pins from working out and allowing brakes to drop down; brake beams should be most carefully looked over in connection with all of their attachments; center plates should be checked up to see if they register properly, that the car is not off center or the center pin broken; shattered journal boxes, broken bolsters and side frames, also journal boxes having packing or even the bearing missing, should be constantly safeguarded



0-4-20 10M Form 668

Chicago, Milwaukee & St. Paul Railway Co.

CAR DEPARTMENT

Repairing and Cleaning Air Brake Apparatus, Car Department

....19 ___

MR J. ELDER H.
Air Brake Instr.,
Milwaukee Shops.

Dear Sir:
Following is report of Air Brake work performed at ....

for the month of ....19 .....

	Passenger System	Passenger Foreign	Freight System	Freight Foreign
1. Total number of brake cylinders cleaned				
2. Total number of triple valves cleaned, including check valve ground in, and triple valves tested				
3. Total number of triple valves changed and sent to main shops for cleaning and testing				
4. Total number of triple valves repaired, grinding in check valves not to be considered as repairs				
5. Total number of packing leathers renewed				
6. Total number of cars tested				
7. Total number of air hose applied				
8. Total number of angle cocks repaired				
9. Total number of retainers repaired				
10. Total number of freight cars that had not been cleaned within 12 Mos.—Passenger cars, 3 Mos.				
11. Total number of freight cars marked out due to inoperative brakes when incoming air brake inspection was made. **Old Date Air** or **Defective Rigging** not to be considered				
12. Total number of freight cars arriving in trains with air brakes **Cut Out** and no air brake defect card attached				
13. Total number clack adjusters cleaned on Passenger Equipment				

Fig. 4—Keeping Track of Air Brake Conditions and the Amount of Brake Work Performed

in order to avoid derailment. It should be kept in mind that draft gears receive most of their damage in switching and each should be inspected after being placed in trains because draft bolts will probably be found broken, follower plates out of place, draft timbers spread, split, or shattered, carrier irons or coupler tie straps down, yoke rivets or yoke broken and coupler, knuckle, lock or knuckle pin broken. Such failures happen daily through setting equipment out en route. Where hot boxes do occur requiring the setting out of a car, report always ought to be made of this fact in order to prevent the same car being taken out by some other crew unawares, resulting in a failed journal and subsequent derailment.

It is suggested that wheels be changed on empty cars finding their way into loading territory and replacements of bearings and packing be made as much in advance of loading as possible so that the journals can be broken in and avoid heating under the return loaded movement.

Transferring and Adjusting of Loads

The handling of equipment requiring adjustment of loads or complete transferring is a most important matter, especially at this time when business is not the best. Every moment of delay accorded a car means just that much dissatisfaction on the part of a patron so that good judgment and prompt action is necessary to guard against any chances being taken with a shipment destined to a distant point which might involve its subsequent damage.

Safety Appliances

This is a matter requiring constant vigilance, proper inspection, and a careful check daily by the man in charge. If this simple rule is lived up to, very little embarrassment will result, it being understood that the local man has a thorough knowledge and understanding of government requirements.

Air Brakes

Aside from the general inspection, and maintenance of air brakes commonly known to all, the amount of work done in this branch of the service should be carefully recorded by the local man to ascertain, if possible, whether he is doing his share, considering the number of cars handled by him, and in order to maintain the required cycle of cleaning, testing, etc. A form showing just how such work can be kept track of satisfactorily is shown in Fig. 4.

Material

A certain ratio or percentage of labor to material ought to be maintained at any point where there is a normal and fixed operation. Nobody can check this up better than the local man in charge, and aside from looking ahead to see that a suitable supply of required items is kept in stock, proper effort ought to be made to see that an excessive stock is not maintained. Proper credits should also be received for scrap which has been recovered. This can be taken care of on a simple form, which is in effect a request on the division storekeeper for credit, on which the foreman lists the material and states to what account credit should be allowed. Every usable item possible ought to be reclaimed and conserved within the means of the facilities provided. This will, of course, require the local man's hearty interest and earnest co-operation so as to avoid waste in every possible form.

Selecting and Preparing Cars for Loading

No greater responsibility is placed upon a local foreman than that of seeing to it that every car loaded within his radius of service is made fit and suitable for the commodity it is to carry, both as to condition of the door fixtures, doors, roofs and all the superstructure, as well as the running gear, brake rigging, etc. This should be a matter of daily personal check by him so that the loss and damage account can be minimized and the service protected to a maximum degree. Were each man at every outlying station to do his full share in this direction, it is certain that the number of loaded cars that now show up in unfit condition, would be reduced and a proper selection made for each grade of freight offered.

The best advice for every local car foreman is the old and simple rule of getting knowledge and understanding, and determining to make the most possible out of the future by doing the best that is in his power. There are no new receipts for success in life. A good aim, deligence in learning every detail of the business, honest, hard work and determination to succeed will win out every time unless some exceptional accident or misfortune interferes. Many opportunities come to every man. It depends upon himself and upon

what he desires to make of himself, what he makes of opportunity and what it makes of him. Each man must stand by his record. If he has been able to do any good, he should be glad. If he has made any mistakes, they ought not to have been intentional. If he has injured anyone, he should be sorry.

Tact stands above all else. It is so easy to recognize, yet so hard to acquire. The first essential is loyalty, otherwise known as system, organization, or any one of a dozen different things. A foreman with tact will have the loyalty of his entire force. At any station, even though it may be poorly equipped mechanically, where the human equipment is in good order we find, in every case, that the unknown quantity is always within this same human element and the equation must be solved by the foreman to find its value. The degree of effectiveness attained depends upon the ability of the man in charge.

Discussion

Several of those who took part in the discussion expressed some doubt as to the practicability of some of the forms suggested by Mr. Sillcox on the ground that the foreman at an outlying point would not have sufficient clerical help to relieve him of doing the work himself, and that this would interfere with his more important duties as a supervisor. It was pointed out, however, that in the absence of such forms the foreman was required to report a considerable part of the same information by letter and that the form in which information was presented in this way was such that a large amount of correspondence was usually required before such reports could be interpreted in a satisfactory manner. On the other hand, the forms are specific and are easily filled out. Mr. Sillcox referred to the fact that before they were put into effect on the Chicago, Milwaukee & St. Paul, the foremen were freely consulted and had offered no objection to their use. In commenting particularly on the use of the form shown in Fig. 2, he stated that by careful supervision, overtime had been reduced in a year from 16 per cent to 6 per cent of the total payroll.

Several of those who took part in the discussion expressed the opinion that such records as outlined by Mr. Sillcox would be of great value in giving these men a better grasp of the business side of their work.

The fact was also brought out that the inspection form, shown in Fig. 3, has greatly reduced the friction between the transportation department and the car department in question such as those involving terminal delays. The inspection form, which must be delivered to the conductor before the train leaves a terminal and then turned over to the inspector on arrival, provides a clean record which has enabled controversies to be settled on the ground.

The information reported by the local foreman on these forms is compiled into general statements for the system and each car foreman receives a copy of the monthly bulletin in which the results of all operations of the department are published, thus tying up his own results with those of the system as a whole.

Welding Cylinders with Tobin Bronze

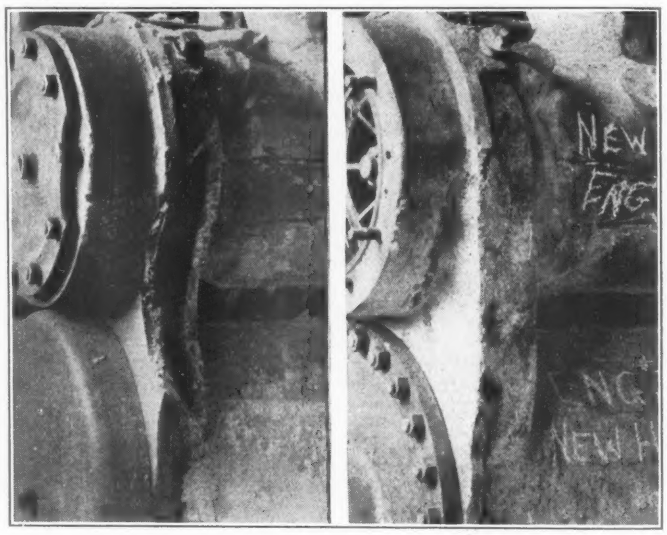
BY JOSEPH T. PAIGHT

General Oxweld Inspector, New York, New Haven & Hartford, New Haven, Conn.

A locomotive was received at a repair shop recently with the left cylinder broken as shown in the illustration. It was decided to make the repair by welding, using Tobin bronze as a flux to hold the broken parts in place and fill in where any parts were missing.

In preparation for the weld, the piston and main valves were removed, the exhaust nozzle plugged up and two circular discs of sheet iron cut out just large enough to fit inside the cylinder and valve chamber studs. The edges of the broken cylinder and the broken parts were chamfered to an angle of 45 deg., being drilled and tapped on the inside to receive ½-in. tap bolts. These short tap bolts were screwed in to within ¼ in. of the heads and greatly strengthened the weld as finally made. A 1/16 in. chip, 1¼ in. wide, was also taken externally all around the break, so there would be no difficulty in tinning the casting. The broken pieces were then welded together and set in place, being tacked to the cylinder at four places.

With these initial preparations, an oil torch was applied first in the big cylinder and then in the valve chamber, burning slowly for about 10 min. in each. The circular sheet iron discs were applied, being held in place by four nuts, and the torch inserted through the back head of the cylinder, burning slowly. In about an hour's time the cylinder was



Cylinder Before and After Welding with Tobin Bronze

too hot to touch and the flame was then reduced, being allowed to burn slowly while the weld was made. The weld across the bottom was completed by one man and two were used to weld the two sides at the same time until they had welded nearly to the top. The weld was completed by one operator as shown in the right section of the illustration and covered up with asbestos, the torch being removed from the back head and the hole plugged up. In the morning the cylinder was cool and when the motion work had been reapplied, the locomotive was returned to service.

In welding cast iron with bronze, the method is to heat a little place on the casting about 1½ in. long and put a thin coating of bronze over it similar to the method of tinning parts before soldering them. The casting is tinned from 1 to 1½ in. ahead of the weld, and by using this method, a good strong weld is obtained.

About 75 lb. of Tobin bronze was used on this welding job and the time required was eight hours. This was considerably less than would have been required by the older method of welding due to several causes. It was not necessary to build a firebrick oven around the entire cylinder and then tear it down again; since the temperature was low, only a short time was required to pre-heat and finally cool the cylinder; the cylinder was not distorted so the bushings did not need to be rebored; in addition, the actual welding with bronze is more rapid than with cast iron rods. That cylinders can be satisfactorily welded with Tobin bronze is attested by the fact that several, repaired by this method, have been in service for seven months, giving no trouble.

Modifications in Rules Proposed by C. I. C. I. & C. F. A.

Load Limits; Billing Where Wrong Material Is Applied; Revision of Prices for Labor and Material

THE first part of the discussion of the Rules of Interchange which took place at the meeting of the Executive Committee of the Chief Interchange Car Inspectors' and Car Foremen's Association on March 3 and 4 was published in the April and May issues of the *Railway Mechanical Engineer*. The continuation of the recommendations pertaining to changes in the freight car rules and the discussion are given below.

Rule 84

F. H. Hanson: Referring to Rule 84, I move that the words "Cut journals" be eliminated from this rule.

The motion was seconded and carried.

M. E. Fitzgerald: I make a motion also to eliminate "axles bent" as that is taken care of in Rule 32 and Rule 43.

The motion was seconded and carried.

Rule 86

M. E. Fitzgerald: There is conflict between Rule 86, page 90, and the loading rules. You have a total weight on rail in Column A for cars of 60,000 lb. and 40,000 lb. capacity. The loading rules advise that those cars may not be loaded in excess of 10 per cent of the stenciled capacity, and the 95,000 lb. for the 60,000 lb. capacity and the 66,000 lb. for the 40,000 lb. capacity, shown in Column A, Rule 86, should be changed, properly correcting the rule so that there is no conflict with loading rules.

A. Herbster (N. Y. C.): Does not Rule 2, page 12, second paragraph, take care of that?

M. E. Fitzgerald: Yes, under the loading rules you could put 66,000 lb. in the car and, taking that together with the stenciled light weight, it will exceed 95,000 lb. in some cases. It is confusing to the car inspectors, station agents and others.

F. W. Trapnell: We had that up with Mr. Hawthorne for an interpretation and he said it had been referred to the Committee on Trucks for them to give us a decision on it. He said that as soon as they rendered a decision they would furnish it.

Chairman Gainey: I do not believe you will get that changed. From an engineering standpoint the eight journals are figured to carry so much, and I do not believe they will give you over 95,000 lb.

F. W. Trapnell: The loading rules permit us to load those two kinds of cars ten per cent above marked capacity. That is all we are asking, just an interpretation on the 40,000 lb. and 60,000 lb. capacity cars.

M. E. Fitzgerald: Paragraph (c), Rule 2, applies to cars of 80,000 lb. capacity and over, eliminating reference to the 60,000 lb. and 40,000 lb. cars, and making the maximum shown in Column A, Rule 86, apply only to the heavier cars.

E. H. Mattingley: A great many 60,000 lb. capacity cars are running around the country today that, by loading them according to the loading rules, ten per cent over their marked capacity, will weigh more than 95,000 lb. at the rail. The shipper will say, "I can load ten per cent over the marked capacity." If that car has a light weight of 40,000 lb., it is overloaded. What are you going to do? Is it transferable in interchange? According to loading rules, it is not; according to Rule 86, it is.

Mr. Pellien: It seems to me a recommendation to increase the limits on these two capacity cars will take care of that. Permit them to load ten per cent above capacity by increasing the limits of wear sufficiently to take care of that excess light weight. The total weight on rail of 95,000 lb. is based on the limits of wear on the 60,000 lb. capacity car of 3¾ in. My idea is that by increasing that to, say, 3⅞ in., or something of that sort, it would place you in a position to load that car to the ten per cent above the marked capacity.

A. Kipp (N. Y. O. & W.): We have some refrigerator cars running as high as 49,500 lb. They haven't any heavier axle than the car that has a light weight of 33,000 lb. There should be some limit of load on the rail, just the same as there is in the others.

M. E. Fitzgerald: Load limit on the rail, shown in Rule 86, takes into consideration a factor of safety provided in all axles. I do not approve of increasing that to take care of further added weight to the car due to draft arms, sills or any other appliances; but our agents and car inspectors responsible for the loading of the cars are placed at a decided disadvantage by the conflict. There is an error in one or the other. I move that we refer the matter to the Arbitration Committee to correct the loading rules, even though we are not discussing them, to bring about harmony in these rules.

The motion was seconded and carried.

Rule 88

M. E. Fitzgerald: Rule 88, referring to handling line using material from its own stock instead of ordering material from car owners, makes the repairing line responsible only for the labor required to correct improper repairs. In the event you apply non-standard lug castings to a foreign car you naturally are forced to wrong frame the draft timbers, possibly the draft sills and end sills. Owners contend that those particular items, the sills, draft timbers and end sills should be furnished from your stock. I contend that the authority granted to put on lugs of other make carries the authority with it to make the necessary wrong repairs to the other items. I think that the rule should be so written because it is not clear.

C. M. Hitch: Mr. Fitzgerald is correct as to the wrong framing of center sills and end sills due to the formation of the draft arms; this is done frequently and I believe his point is well taken.

Chairman Gainey: There is no occasion to frame the draft sills and end sills wrong for any attachment.

A. S. Sternberg: How about the car where the lugs are attached to the center sills?

Chairman Gainey: Frame the draft timbers right for the lugs and bore the castings to fit the sills. In no case will I frame draw sills or end sills wrong. When it comes to draft timbers, I agree with you.

A. Kipp: We have dozens of box cars that we had equipped with draft arms and they have come back home with the wrong framed draft sills, wrong draft timbers and wrong end sills.

M. E. Fitzgerald: It is absurd to give the owner the right to bill you for labor and material when the rules give you a right to put in lugs you may have in your stock. At some points on any railroad you work where there are no facilities to drill the lug castings or chip them out to conform with the original construction of the car. It is not done and even though you can do it, it is not practical.

I move that we recommend that Rule 88 be re-written so that it will convey to us the fact that repairing lines using material from their own stock and forced to wrong frame timbers or other material which they should carry in their stock and are supposed to furnish under this rule, are re-

lieved of responsibility as to material when correction of those wrong repairs are made.

The motion was seconded.

P. M. Kilroy (St. Louis-South Western): The rule as it is written carries his point with it. If he applies the defect card at the time that he makes the improper repairs, he fully complies with the rule and it carries with it everything that he is asking for.

A. Herbster: Irrespective of that, a number of roads are coming back for wrong framed draft timbers, for center sill splices and end sills, claiming this material is carried by every railroad, and that you are applying only the lug casting, which you do not have standard for the foreign car.

P. M. Kilroy: Did you apply your defect card in accordance with the rule?

A. Herbster: For labor only.

M. E. Fitzgerald: You have a rule that tells you certain material you must carry in your own stock. Any deviation from that is construed by the rules as wrong repairs. There is a conflict in the rules.

A. S. Sternberg: I move as an amendment, that there be a committee appointed to frame up a rule in accordance with Mr. Fitzgerald's motion and present it at tomorrow's meeting.

The amendment was seconded.

The motion as amended was carried.

A committee was appointed, and at the next day's session, presented the following report:

Your committee unanimously agrees to submit the following correction to Rule 88. The rule is to read as it is now written up to and including the words "Defect card" in the eighth line, and then follow with the words:

Marked to show such improper material used and such consequent improper framing as may be found necessary, defect cards so issued and marked to cover labor only for correcting such improper repairs.

On motion, the report was adopted.

Rule 95

Mr. Jameson (Southern): I move Rule 95 be changed to read in this manner:

Bills may be rendered against car owners for the labor only of replacing the following material when lost on the line of the company making the repairs: Couplers, including yokes, springs and followers when lost with the couplers; *metal draft arms and* friction draft gear complete, whether or not lost with the coupler.

Metal draft arms now lost on the line of road are billable against the car owner and the coupler is not billable. Metal draft arms are really of a greater value and have not lost any value. They are on the line of road and may be salvaged.

The motion was seconded and carried.

Rule 101

F. H. Hanson: I move that price be provided in Rule 101 for the lubrication of center plates and side bearings.

E. H. Mattingley: It seems to me in order to properly promulgate that rule it will be necessary to proceed along the same lines we did in order to get Rule 66 in the book. You will have to establish a periodical time of doing this so-called lubricating of center plates and side bearings. Otherwise, if we lubricate a car today and a fellow gets it five hundred miles from here, he will lubricate it again.

A. S. Sternberg: We do not want somebody to lubricate the side bearings and center plates on cars of ours every week and pay for it when it is not necessary. I do not think anybody else here does. You have a limit on triple valves, you have a limit on packing of the journal boxes and there should be a limit on this.

E. H. Mattingley: Every time we have made recommendations we have had to give our reasons and we have had to state how the rules should read.

F. H. Hanson: On the New York Central, we have standing orders for every car that goes on to the repair track where cars are jacked up so you can get at the center plates and side bearings, that they are to be greased. If we get a car in our shops today and somebody greased that a week ago, we are certainly not going to grease it again. Nine out of ten of the cars you get the center plates are dry, full of dirt and the side bearings are dry. In those cases we grease them and get nothing for it. The road that does that work should get something for it.

I do not expect to see it put in the rules this year because I agree that the Arbitration Committee expects us, when we make a recommendation, even to go further than he says. They would probably want us to set a price for doing that work, but by making this recommendation it might start something and in another year or so we might work up figures to show what the proper price should be and if necessary, how often this work should be done.

The motion was carried.

Rule 101

Mr. Jameson: In view of interpretation No. 7, following Rule 101, what scrap credit should be allowed if four follower plates weighing 90 lb. are removed on account of being too short and we apply four follower plates which weigh 120 lb.?

Mr. Martin: Rule 103 answers that.

Mr. Jameson: In the answer to question No. 7, following Rule 101, it does not say the weight of scrap. I contend that we are entitled to credit on only the weight of the material removed and charge the actual weight of the material applied.

P. M. Kilroy: I think that the answer is clear. In view of the fact that the Arbitration Committee allows you to credit the good followers removed as scrap, it fully compensates you for the difference in weight. The credit should be passed on Rule 103 as specified.

M. E. Fitzgerald: On page 108, item 175, it says, "Nut locks, or lock nut, all sizes, no credit for scraps, each two cents." Over in the column it says "four cents." Which is correct?

Mr. Jameson: Item 37, Rule 101 on page 104 reads, "Pipe nipple on end of train line, threaded, 12 in. or less in length, applied net includes material cost of nipple, on disconnection and connection only." That is evidently a misprint. Everybody asks what that word "on" means. I do not believe that the intention of the rule was to charge any additional connection.

M. E. Fitzgerald: There have been several hundred letters handled in the Association in connection with Rules 101 and 107. Various items are inconsistent and they will not check up. We ought to pass those rules assuming that they will take care of that unless there is some exception of considerable importance.

C. J. Wymer (C. & E. I.): I think we ought to call their attention to it.

Mr. Jameson: I move that we ask that Item 37, Rule 101, be re-written so that it is clearly stated what the forty-cent charge includes.

The motion was seconded and carried.

Mr. Jameson: Item 61, page 105, reading, "Nipples 12 in. or less in length" does not say that threads are included on the nipple. The Car Builders' Dictionary gives the definition of the nipple as a short piece of pipe threaded on both ends, yet various authorities are interpreting this price not to include the threads. I would like to have that item written intelligently so that there will be no question of a doubt left. I move that Item 61 be corrected to read:

Nipples 12 in. or less in length, threaded on both ends.

The motion was seconded and carried.

Rule 107

Mr. Jameson: I move that we ask that Rule 107 be rearranged so that the items shall appear alphabetically. Some jobs are hidden away in there until it takes a man's time to locate them and it is not businesslike.

The motion was seconded and carried.

Mr. Jameson: Items 85, 112 and 219, Rule 107: What labor is to be charged for a center pin applied with renewal of center plate and the jacking of the car?

When you take a combination of those items, the question is open whether each item should be charged as stated in the rule, no one item referring to the other. When you make up a sample repair card and charge one key center pin, one hour and two-tenths labor; one body center plate on a bolt basis, four body center plate bolts, one hour and six-tenths; car jacked, one hour and five-tenths, it seems to be rather an exorbitant charge.

I move that we add to Item 112:

Not to be allowed when center plate is renewed.

That means that you would allow no extra charge for renewing a center pin when the center plate was renewed at the same time at the same end.

The motion was seconded and carried.

M. E. Fitzgerald: Item 42a, page 125, allowing one hour for tightening truss rods on a loaded car, and Item 35 which allows one hour for applying the queen post including the R. & R. of turnbuckle and two nuts or two lags. This rule would allow one hour for tightening a truss rod on a loaded car and only one hour for tightening the rod and removing the queen post on another car.

I move that the rule be revised to include an allowance for the queen post in excess of the one hour for tightening the rod.

The motion was seconded and carried.

E. H. Mattingley: I would like to get an expression from some of the bill men as to the advisability of rendering a separate bill for the light weighing of cars. At the present time all bills for the repacking of journal boxes are rendered separately from the bill for the repairs. As the light weighing is not a maintenance charge, should we not have a separate bill for the light weighing?

Mr. Martin: We are burdened to death with separate bills. That question has come up in the auditing department as to whether it should be separated. It has been considered that the item is not of enough importance to separate it. We made a mistake when we made a separate charge for packing boxes

President Pendleton: I have two communications addressed to the secretary, from W. J. Morris, master car builder, Atlanta, Birmingham & Atlantic, recommending changes in Rule 107, Item 401A, on the ground that the charges of labor for renewing or replacing truck springs is entirely too small for the actual time taken to do this work, since under ordinary conditions all truck springs cannot be replaced in one cluster in the allotted time; and suggesting that an interpretation be requested on Items 430 and 431, referring to the application of bolts over six inches in length in connection with the renewal of couplers.

C. C. Stone (Southern): I move that we ask the Association to change Item 431 to read,

"When not on any bolt of six inches or *less* in length."

instead of having it read "Six inches or more."

The motion was seconded and carried.

Chairman Gainey: What about the springs, that is, Item 401A?

President Pendleton: The second paragraph of Mr. Morris' letter reads, "For your information this matter was referred to the Committee on Prices for Labor and Material at a recent meeting of the American Railroad Association and they decided that the additional charge for jacking should not be allowed, covered by Item 401A."

Mr. Jameson: It seems that disposes of it.

On Item 64 there is considerable confusion among the bill clerks as to the proper labor charge for a dead lever guide. The item reads, "Brake lever guide or carrier, renewed, each, five-tenths." We have been holding that that covered a dead lever guide. However, some of our car foremen believe that it covers the carrier to the floating lever under the center of the car, and the dead lever guide comes under the head of brake connections, rod or lever, or connection pin, two-tenths. We have dead lever guides that are bolted to the truck bolster and others that are secured with a key bolt.

Chairman Gainey: There are a great many of them riveted on. I think that the committee intended it for the dead lever guide, only they put the two words in there, guide or carrier.

Mr. Owen: I move that Item 64, Rule 107 be changed to read:

"Brake lever guide or carrier to be charged on the bolt or rivet basis including key bolts."

There is a price for key bolts, I believe, which will cover that on the bolt and rivet basis.

Mr. Jameson: I think that ought to read, "On a rivet, bolt or key bolt basis."

The motion was seconded and carried.

M. E. Fitzgerald: I move that the word "hanger," the second word in Item 60A, be changed to "bearing," making it read:

"Brake *bearing* secured by column bolts. Charge for column and brake hanger bolts used in securing same; allow for jacketing car when necessary."

A brake hanger is not so secured; it means brake bearing.

The motion was seconded and carried.

Mr. Jameson: Item 258 of Rule 107 reads: "Renailing roofing or siding, per lineal foot of nailing stringer, one cent." We have no charge for renailing flooring and I think we should be given one. I move that this item be changed to read:

"Renailing roofing, siding *or flooring*, per lineal foot of nailing stringer, one cent."

The motion was seconded and carried.

E. H. Mattingley: I do not believe there is any item in Rule 107 that carries a labor charge for the framing of side ladder sills or cripple posts in connection with the removal of corner posts or other repairs. There should be some labor charge other than on a bolt or rivet basis because bolt basis will not allow sufficient labor for framing of those parts. I make that a motion.

The motion was seconded.

M. E. Fitzgerald: The price of lumber includes all framing in every case. I do not see why we should make a special provision for ladder sides.

E. H. Mattingley: Does the price of the lumber, which is eleven cents a foot, take care of the cost of the lumber and application, including the framing?

A. S. Sternberg: It might not in just this one case of ladder sides, but as a whole it does. It is a very good price.

Mr. Owen: As a rule ladder sides are taken out of stuff that is ripped from heavier timbers and it is not very often, unless they are putting on a great many ladder sides, that it has to come out of new material. The same thing applies to dead woods on 138A on a bolt and rivet basis; you haven't sufficient to cover your framing.

E. H. Mattingley: It is also true that the present rules do not provide for sufficient labor for the dead block. The charge on the bolt and nut basis, if the dead wood is secured in place by body truss rods only, labor for 2.1 hours for nuts and lag screws is not sufficient, taking into consideration the framing of the dead wood.

Mr. Owen: Most of the dead woods do not average over about thirty inches in length and they come off of the ends of timbers.

E. H. Mattingley: I cannot agree that the dead woods as a rule are made from scrap. It is very often necessary to rip or cut down a large piece of timber to make a dead block. Wood used for such purposes must be sound and of good

quality, and if you are going to use scrap, you are not complying with the rules.

The motion was lost.

M. E. Fitzgerald: In connection with repairs to tank cars I call your attention to Item 278B which reads, "Running board, tank cars, end or side, renewed; per lineal foot, including all bolts, fitting and boring, eleven cents a foot." It is impossible to recover thirty per cent of the value of material and work performed in repairing running boards on tank cars. I move that a new price be applied to Item 278B. In many cases we have sixty-nine bolts in the corner of a tank car and it would not pay for the bolts.

The motion was seconded and carried.

Mr. Jameson: Item 275A reads, "Running boards, latitudinal, from side ladder to longitudinal running board, secured by bolts, renewed, per single board, four-tenths hours for ordinary cars and for refrigerator cars, four hundredths hours." It is an error in printing. I move that we ask that it be corrected.

The motion was seconded and carried.

E. H. Mattingley: I move that a resolution be presented by this Association to the Arbitration Committee calling particular attention to the large number of tank cars now in service and the very few items listed in Rules 101 and 107 to cover charges for repairs to tank cars, requesting them to give the matter special attention and provide more charges for such work.

The motion was seconded.

Secretary Elliott: The underframe should be covered in the other rules. It seems to me on the tank itself is pretty well covered on the rivet basis, hours labor for straightening, testing, etc. Do you have any items in mind that are not covered?

E. H. Mattingley: A great many of our tank car friends are making repairs to the tank itself, and billing for boiler maker labor, blacksmith labor, etc.; there are many different rates in effect at those plants and they are not uniform. The price committee should be able to provide ample charges, as they have done for the steel underframe of the same car, to compensate the owner for the repairs made by him. Why could we not have uniform charges for that work and get away from this unnecessary correspondence?

Mr. Jameson: We have an item in Rule 107 that covers those repairs. Item 443 reads: "Repairs of steel tanks of steel cars; labor repairing and testing, per hour, $1.45." I believe that word "Steel" has been stricken out, making it read: "Repairs of steel tanks of tank cars; labor repairing and testing, per hour, $1.45."

F. H. Hanson: I agree with Mr. Mattingley, but we recently have had several cases where the owner would present a bill showing possibly a third or a half more than the M. C. B. prices per hour, and when we would refer them to the A. R. A. rules they would say, "We are not a party to this; we do not care what your prices are. This is what it cost us to get the tank repaired and this is what we expect you to pay. Since some of those cases came up with us, we issued a defect card, accompanied with a letter telling them, "This carries with it information making the repairs covered by the defect card in accordance with the A. R. A. rules." In one case that I recently know of, the owner came back and told us that it would be impossible for him to get his car repaired on that basis and if we would not stand the extra charge he preferred that we take the car in our shops and put it in good condition, which we did. I would like to know how you are going to get a rule covering that.

P. M. Kilroy: The defect card, when you attach it to the car, governs the price that shall be charged between parties to the rules. You cannot bind an outsider by virtue of attaching a defect card to the car. That is the reason tank car companies are charging you what it really costs them.

E. H. Mattingley: I have in mind the tank car companies that are parties to the present rules. Most of our large tank car companies are parties to the rules.

Mr. Martin: The great trouble with bills for repairs to tank cars is that there is no uniformity. You get a bill and you get so many hours labor in accordance with Rule 107, Item 443. It is a practical impossibility under the present rules to check the repairs to a tank car. I do not see why we cannot get to a rivet basis on repairing the cistern of a car.

The motion was carried.

C. C. Stone: I move that Item 158 of Rule 101 be placed in Rule 107. Rule 101 covers material charges and Rule 107, labor charges.

The motion was seconded.

Secretary Elliott: You would have the same confliction when you got to Rule 107 as now. When you get to Rule 107 you could as well ask to have it put back in 101 again. It is a double charge, isn't it? It is a net charge.

C. C. Stone: It used to be a net charge but it is not now.

The motion was carried.

Mr. Jameson: Items 170 to 176 inclusive, are draft timber items. None of these items specifies that it includes the R. and R. of coupler. The question has been raised, is it proper to make labor charge for the R. and R. of coupler, as per item of 107 in addition to the labor shown for the above draft timber items? Rule 110 now being eliminated leaves this an open question. Further, the labor on the majority of the draft timber items has been reduced, contrary to the general increase of labor items which, to my mind, indicates that the price committee intended that we should charge for the R. and R. of coupler when draft timbers were R. and R. or renewed.

I move that Items 170 to 176 of Rule 107 include coupler R. and R.

The motion was seconded.

M. E. Fitzgerald: You previously stated that the labor charge now quoted was reduced and you wanted it added, I believe. If so, your motion as put is wrong.

Mr. Jameson: I said exactly what I intended to say. Under the present reading of the rules, I believe that you have a perfect right and can substantiate your charge for coupler R. and R. at the same time draft timbers are R. and R. renewed. However, I do not believe you should have four hours additional for applying coupler with draft timbers. Therefore, I made my motion as I think it really should be. Under the rules as they now read, you can charge for coupler R. and R. That is my opinion. I think that the draft timber items should include the R. and R. of coupler as it does the other items.

Mr. Martin: I think the intent is to eliminate overlapping labor and as far as possible to make the labor charge on each and every individual item. I think that the charge as it is, allowing for the R. and R. of coupler in addition to the charge is proper.

A. S. Sternberg: Page 120, Rule 107 says: "Unless otherwise specified, the labor allowances include all work necessary to complete each item of repairs." It appears to me that takes care of it.

Chairman Gainey: Strict reading of the rules does not allow you for dropping that coupler and putting it up. It pays you for putting up the draft timber and all work included in that and the rule is plain on that.

The motion was lost.

Mr. Jameson: Then I would like to have this body express an opinion on that. I move that we go on record to the effect that Items 170 to 176 of Rule 107 include the R. and R. of coupler.

The motion was seconded and carried.

(*The proceedings of the meeting will be concluded in the July issue.*)

Labor Board Announces General Wage Reduction

Average Decrease in Rail Rates Is 12 Per Cent; Shop Crafts Cut 8 Cents an Hour, or 9 Per Cent

A GENERAL wage reduction in which the rates for practically all shop employees were lowered 8 cents an hour was announced by the Railroad Labor Board on May 31. The ruling it is estimated will reduce the total payrolls of the railroads about $400,000,000 a year. The reduction becomes effective July 1, the date which the national agreements will be abrogated.

The average percentage of reduction, as estimated by members of the Labor Board, is 12 per cent. The decreases in wage rates vary from 5 to 13 cents, or from 5 to 20 per cent. The majority of the shop crafts receive a reduction of 9 per cent, while car repairers' wages are cut about 10 per cent. For section men the reduction is approximately 18 per cent and completely wipes out the increase granted in the wage award of July, 1920. The pay of common labor, on which the railroads sought to obtain the greatest reduction, is to be cut 6 to 8½ cents an hour.

Passenger and freight engineers, who received increases of 10 to 13 cents an hour by the 1920 award, are to be cut 6 and 8 cents an hour respectively. Passenger and freight conductors who received increases of 12½ and 13 cents in 1920 are cut 7½ and 8 cents by the new schedule. The smallest reduction will apply to office boys and other employees under 18 years old who will receive 5 cents an hour less after July 1. This takes away the increase granted last year.

Clerks are reclassified so that entering clerks will receive a monthly salary of $67.50 for the first six months and $77.50 for the second six months of service. Clerks with less than one year's experience now receive $120.

A new monthly schedule for floating equipment employees on ferries, tugs and steam lighters gives captains $200, engineers $190, and firemen and oilers $140. On lighters and barges captains will receive $120 to $150; engineers, $140 to $160, and mates, $100.

New Rates Will Be Applied on All Roads

While the decision affects only 104 roads, it will apply eventually to every railway in the country. About 100 roads whose requests for reductions were filed after April 18, when the hearing started, will present their cases to the board commencing June 6. Some of the roads sought reductions in common labor only; others included other groups and some have asked new wage scales for all classes. The board's decision sets up new uniform scales for all groups of employees and instructs each company involved to apply the new scales to the special groups whose pay it has asked to have reduced.

Reduced costs of living and reduced wages in other industries were the major factors on which the wage cuts were based by the board. The decision points out that the adjustment period has produced conditions in whose burdens all have to share. It says the wage problem with which it dealt is an economic one and should not be regarded as a struggle between capital and labor or the managements and employees.

In a supplemental memorandum the board points out that during government control the wages of railway employees were increased from an average of $78 a month in December, 1917, to $116 in January, 1920, or about 20 per cent. The board's decision last year, effective May 1, 1920, increased wages 22 per cent, or to an average of $141 a month. After this increase the workers, according to the findings, were receiving an average of 81 per cent more than they were getting before Federal control and about 10 per cent of the number, chiefly the lower paid unskilled workers, had received increases in excess of 100 per cent. The board estimates that the cuts of 12 per cent would mean an average monthly wage of about $125 for all employees.

In its decision the board sets forth some of the conclusions on which it acted as follows: It finds that since the rendition of its decision No. 2 (last year's wage increase) there has been a decrease in the cost of living. What that decrease has been it is impossible to state with mathematical accuracy, or even what the general average for the United States has been up to and on any given date. The machinery for procuring and stating with accuracy the data to fix this is by no means perfect. The decreases vary greatly according to the locality, and affect different persons in different degrees. In the cities the general decreases in some lines have been offset to some extent by the high rents. In some of the items in the cost of living the fall in prices has been great, in others much less.

The board also finds that the scale of wages for similar kinds of work in other industries has in general been decreased. The decreases vary in different industries and in different localities. There has been a decrease and the present tendency is downward.

But the most unfortunate condition is that in many localities large numbers are out of employment on account of the prevailing depression and hence without wages.

In a decision of this character it is not practical to fix rates applying with exact ratio to each individual employee and each separate locality, for the reason that necessity compels the board to accept certain standardizations of pay for railroad employees. But these standards are now somewhat different in different regions and so the decreases will have relatively the same general effect.

There are certain facts and conditions known to all and which can neither be disputed nor ignored. Whatever may be said as to the origin or contributing causes there has been and is a marked, and to some extent distressing and disastrous, depression in business and industry affecting the entire country and some lines of production most seriously. As a result heavy financial losses have been suffered and many hundreds of thousands thrown out of employment and deprived of all wages and this loss of purchasing power by them has in turn accelerated the general depression by reducing the demand for the products they would otherwise have purchased.

While it has been argued that the fall in prices has not reached the consumer to any large extent, it has without question most disastrously reached and affected the producers, especially some lines of manufacture and the agricultural classes. It should be recognized by all that the problem before us is chiefly an economic one and we are all confronted by adverse and troublesome conditions which every one must help to solve.

Details of Wage Cuts

The reductions per hour for the various classes of employees under the decision are as follows:

Article II—Clerical and Station Forces

For the specific classes of employees listed herein and named or referred to in connection with a carrier affected by

this decision, use the following schedule of decreases per hour:

(Note—For clerks without previous experience hereafter entering the service of a carrier, rates of wages specified in Sec. 3 (b), this article, are hereby established.)

Sec. 1. Storekeepers, assistant storekeepers, chief clerks, foremen, subforemen and other clerical supervisory forces.......6 cents.

Sec. 2. (a) Clerks with an experience of two (2) or more years in railroad clerical work, or clerical work of a similar nature in other industries, or where their cumulative experience in each clerical work is not less than two (2) years.......6 cents.

(b) Clerks with an experience of one (1) year and less than two (2) years in railroad clerical work, or clerical work of a similar nature in other industries, or where their cumulative experience in such clerical work is not less than one (1) year.......13 cents.

Sec. 3. (a) Clerks whose experience as above defined is less than one (1) year.......6½ cents.

(b) Clerks without previous experience hereafter entering the service will be paid a monthly salary at the rate of sixty-seven dollars and fifty cents ($67.50) per month for the first six (6) months, and seventy-seven dollars and fifty cents ($77.50) per month for the second six (6) months.

Sec. 4. Train and engine crew callers, assistant station masters, train announcers, gatemen and baggage and parcel room employees (other than clerks).......10 cents.

Sec. 5. Janitors, elevator and telephone switchboard operators, office, station and warehouse watchmen, and employees engaged in assorting, way bills and tickets, operating appliances or machines for perforating, addressing envelopes, numbering claims and other papers, gathering and distributing mail, adjusting dictaphone cylinders and other similar work.......10 cents

Sec. 6. Office boys, messengers, chore boys, and other employees under eighteen years of age, filling similar positions, and station attendants.5 cents.

Sec. 7. Station, platform, warehouse, transfer, dock, pier, storeroom, stock room and team-track freight handlers of truckers, and others similarly employed.......6 cents.

Sec. 8. The following differentials shall be maintained between truckers and the classes named below:

(a) Sealers, scalers and fruit and perishable inspectors, one (1) cent per hour above truckers' rate as established under section 7.

(b) Stowers or stevedores, callers or loaders, locators and coopers, two (2) cents per hour above truckers' rate as established under section 7. The above shall not operate to decrease any existing differentials.

Sec. 9. All common laborers in and around stations, store houses and warehouses, not otherwise provided for.......8½ cents.

Article IV—Shop Employees

(Note—For car cleaners' rates of wages fixed by a differential shown in section 4, this article, are hereby established.)

Sec. 1. Supervisory forces.......8 cents.

Sec. 2. Machinists, boilermakers, blacksmiths, sheet metal workers, electrical workers, carmen, moulders, cupola tenders and coremakers, including those with less than four years' experience, all crafts.......8 cents.

Sec. 3. Regular and helper apprentices and helpers, all classes..8 cents.

Sec. 4. Car cleaners shall be paid a rate of two (2) cents per hour above the rate established in section 6 of article III, this decision, for regular track laborers at points where car cleaners are employed.

Article VI—Engine Service Employees

Sec. 1.—Passenger Service

Class	Per mile	Per day
Engineers and motormen	$0.48	$0.48
Firemen (coal or oil)	.48	.48
Helpers (electric)	.48	.48

Sec. 2.—Freight Service

Class	Per mile	Per day
Engineers (steam, electric or other power)	$0.64	$0.64
Firemen (coal or oil)	.64	.64
Helpers (electric)	.64	.64

Sec. 3.—Yard Service

Class	Per hour
Engineers	$0.08
Firemen (coal or oil)	.08
Helpers (electric)	.08

Sec. 4.—Hostler Service

Class	Per day
Outside hostlers	$0.64
Inside hostlers	.64
Helpers	.64

Article VII—Train Service Employees

Sec. 1.—Passenger Service

Class	Per mile	Per day	Per month
Conductors	$0.004	$0.60	$18.00
Assistant conductors or ticket collectors	.004	.60	18.00
Baggagemen handling both express and dynamo	.004	.60	18.00
Baggagemen handling express	.004	.60	18.00
Baggagemen	.004	.60	18.00
Flagmen and brakemen	.004	.60	18.00

Sec. 2.—Suburban Service (Exclusive)

Class	Per mile	Per day	Per month
Conductors	$0.004	$0.60	$18.00
Ticket collectors	.004	.60	18.00
Guards performing duties of brakemen or flagmen	.004	.60	18.00

Sec. 3.—Freight Service

Class	Per mile	Per day	Per month
Conductors (through)	$0.64	$0.64	....
Flagmen and brakemen (through)	.64	.64	....
Conductors (local or way freight)	.64	.64	....
Flagmen and brakemen (local or way freight)	.64	.64	....

Sec. 4.—Yard Service

Class	Per mile	Per day	Per month
Foremen	....	.64	....
Helpers	....	.64	....
Switchtenders	....	.64	....

Article VIII—Stationary Engine (Steam) and Boiler Room Employees

Sec. 1.	Stationary engineers (steam)	$0.08
Sec. 2.	Stationary firemen and engine room oilers	.08
Sec. 3.	Boiler room water tenders and coal passers	.06

Article XII—Miscellaneous Employees

Sec. 1. For miscellaneous classes of supervisors and employees in the hereinbefore named departments properly before the Labor Board and named in connection with a carrier affected by this decision, deduct an amount equal to the decreases made for the respective classes to which the miscellaneous classes herein referred to are analogous.

Sec. 2. The intent of this article is to extend this decision to certain miscellaneous classes of supervisors and employees submitted by the carriers, not specifically listed under any section in the classified schedules of decreases, and authorize decreases for such employees in the same amounts as provided in the schedules of decreases for analogous service.

Article XIII—General Application

The general regulations governing the application of this decision are as follows:

Sec. 1. The provisions of this decision will not apply in cases where amounts less than thirty dollars per month are paid to individuals for special service which takes only a part of their time from outside employment or business.

Sec. 2. Decreases specified in this decision are to be deducted on the following basis: (a) For employees paid by the hour, deduct the hourly decrease from the hourly rate. (b) For employees paid by the day, deduct eight times the hourly decrease from the daily rate. (c) For employees paid by the month, deduct two hundred four times the hourly decrease from the monthly rate.

Sec. 3. The decreases in wages and the rates hereby established shall be incorporated in and become a part of existing agreements or schedules or future negotiated agreements or schedules, and shall remain in effect until or unless changed in the manner provided by the Transportation Act, 1920.

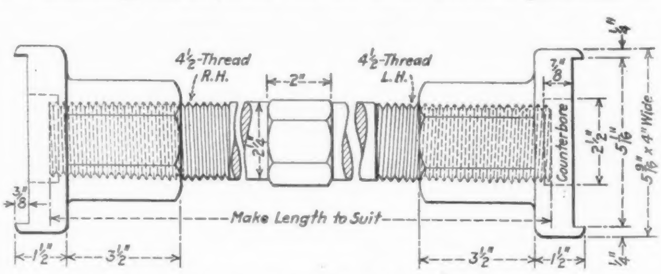
Sec. 4. It is not intended in this decision to include or make decreases in wages for any officials of the carriers affected except that class designated in the Transportation Act, 1920, as "Subordinate Officials" and who are included in the act within the jurisdiction of this board. The act provides that the term "Subordinate Officials" includes officials of carriers of such class or rank as the Interstate Commerce Commission shall designate by regulation duly formulated and issued. Hence, whenever in this decision words are used, such as foremen, supervisors, etc., which may apply to officials, such words are intended to apply to only such classes of subordinate officials as are now or may hereafter be defined and classified by the Interstate Commerce Commission as "Subordinate Officials" within the meaning of the Transportation Act, 1920.

The decision stipulates that its provisions are not to apply in cases of employees receiving less than $30 a month for special service requiring only part time.

Railway executives expressed disappointment when informed of the decreases and several stated they considered them inadequate under present conditions. B. M. Jewell, president of the Railroad Department of the American Federation of Labor, refused to make any comment.

Device for Spreading Locomotive Frames

The illustration shows a device for spreading locomotive frames previous to Thermit welding. It was developed by the blacksmith foreman of the Yazoo & Mississippi Valley at Vicksburg, Miss., and can be used between pedestals or



Adjustable Frame Spreading Device

long sections of frames by applying different length screws. The device is simple, effective and easily manufactured in any railroad shop.

New

And Improved

Machine Tools

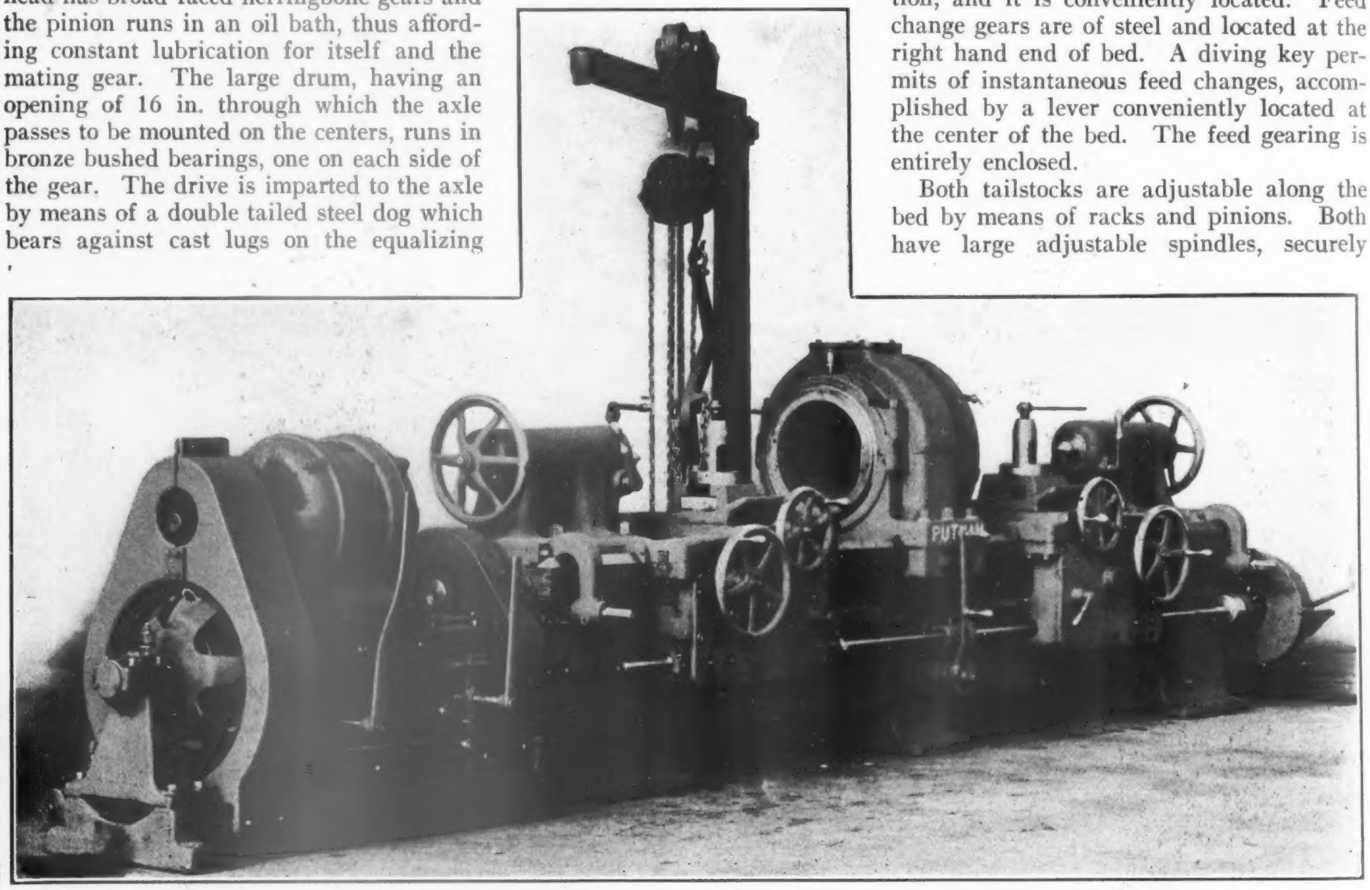
And

Shop Equipment

High Production Double Axle Lathe

MANY valuable features are included in the heavy duty double axle lathe recently developed by the Putnam Machine Works of Manning, Maxwell & Moore, Inc., Fitchburg, Mass. These features include ease of manipulation, accuracy and plenty of power and weight to take heavy cuts without vibrating. The general ruggedness of the machine as a whole is evident from the illustration.

The machine bed is a deep box section with side walls connected at short intervals by broad box ties. Longitudinal trusses are provided, having cast racks against which the tailstocks are braced for severe duty. The center driving head has broad faced herringbone gears and the pinion runs in an oil bath, thus affording constant lubrication for itself and the mating gear. The large drum, having an opening of 16 in. through which the axle passes to be mounted on the centers, runs in bronze bushed bearings, one on each side of the gear. The drive is imparted to the axle by means of a double tailed steel dog which bears against cast lugs on the equalizing plate. The action obtained by the use of herringbone gearing is one of extreme smoothness of cutting and freedom from chatter. The head is clamped to the bed by six large bolts.



Ease of Operation, Accuracy and High Power Are Features of the New Putnam Axle Lathe

The carriages are guided by large V-ways on the front and rear of the bed, an additional flat bearing being provided directly under the tool. This not only furnishes a rigid support for the tool blocks, but by reducing the span of the carriage bridge between the ways insures freedom from distortion and subsequent binding of the carriage. The carriages are gibbed on horizontal and vertical surfaces directly in line with the tool thrusts. A large poppet and ring provide a convenient means of locating and clamping the tool. Cast channels in the carriage carry the cutting lubricant to a trough at the rear of the bed. Sliding surfaces are protected by wipers attached to the carriage.

The feed aprons are of rigid, double wall construction, furnishing support for all shafts at both ends. The feed motion is transmitted through a worm and worm wheel. The worm receives its power from a double splined shaft on the front of the bed. All radial and thrust loads on the worm are absorbed by large ball bearings. The feed is thrown in or out of engagement by a small, conveniently placed lever which in turn operates a positive jaw clutch, no friction being used. An automatic stop disengages the feed at any predetermined point. The worm and wheel, together with the absence of distortion in the apron, impart an unusually smooth motion to the tool.

Special attention has been paid in the design to reducing the overhang of the apron beyond the edge of the bed. This allows the operator to get close to the work. The position of the hand-wheel has likewise been given careful consideration, and it is conveniently located. Feed change gears are of steel and located at the right hand end of bed. A diving key permits of instantaneous feed changes, accomplished by a lever conveniently located at the center of the bed. The feed gearing is entirely enclosed.

Both tailstocks are adjustable along the bed by means of racks and pinions. Both have large adjustable spindles, securely clamped by means of plug binders. Permanent alinement of spindles is maintained by means of taper gibs, one on each tailstock body. Pawls attached to the body engage cast racks in the bed to prevent slipping under heavy cuts. A crane for handling axles in and out of the lathe is furnished when ordered and a one ton quick acting hoist is provided. The liberal use of ball and roller bearings makes it an easy matter for one man to operate the hoist.

A centrifugal pump supplies the cutting lubricant directly to the tools by means of conveniently located pipes. This pump takes the lubricant from a tank attached to back of the bed. It returns to the tank by means of large, open channels, thus preventing trouble by pipes clogging.

Machines can be furnished with any one of four types of drive; namely, single pulley belt drive, constant or variable speed motor drive, or four step cone pulley belt drive and countershaft. When driving by a single pulley belt, or constant speed motor, drive is through a unit and self-contained gear box, giving four speeds in geometrical progression through sliding gears. These gears are all of chrome nickel

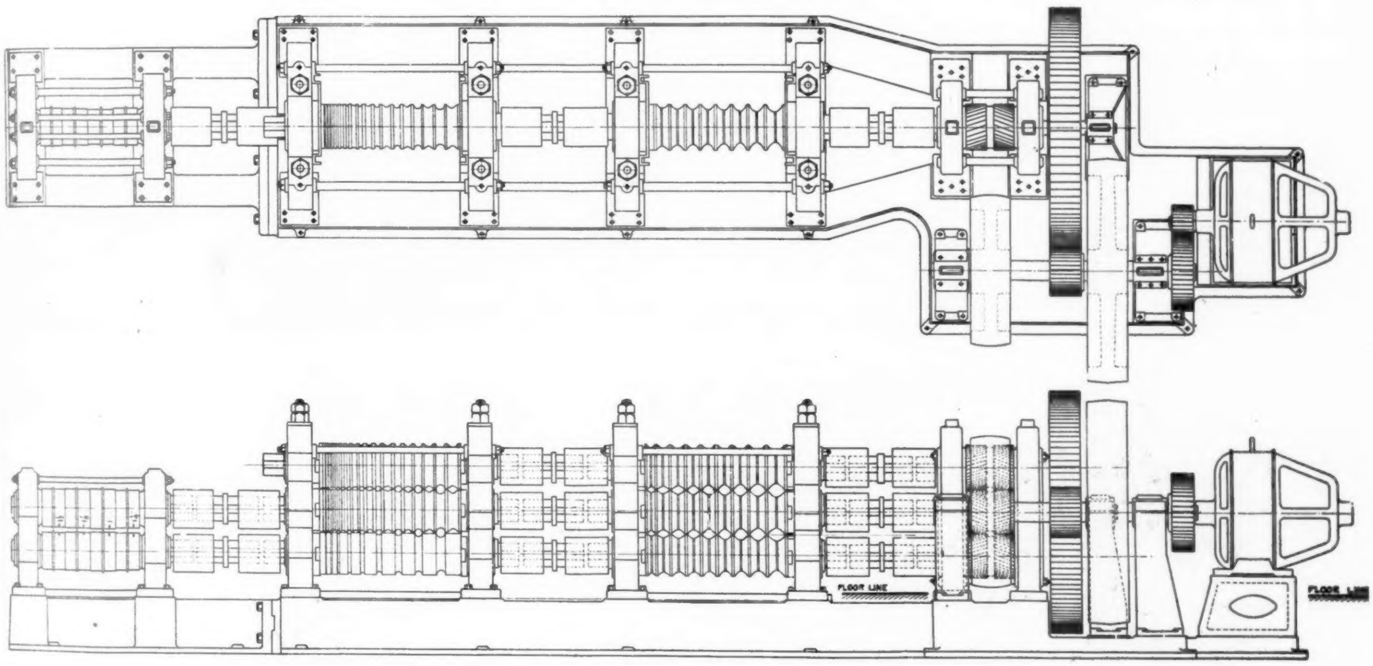
steel, heat treated and hardened, and operate under continuous flood lubrication. A gear shifting lever, positively interlocking in every position, makes it impossible to engage conflicting gear trains at any time.

When the machine is belt driven, power is transmitted to the gear box through a single pulley of large diameter and wide face, running at constant speed. For starting and stopping, a powerful friction clutch is employed. Two control levers for this clutch are provided, one near the carriages at the operator's natural position, and the other at the gear box, to be used when shifting gears. When stopping the lathe, the act of disengaging the friction clutch automatically applies a friction brake, bringing the machine to a full stop almost instantly. Moreover, the interlocking mechanism is such that the friction clutch must be released and the brake applied before gears can be shifted for a speed change.

New Model Scrap Reclaiming Rolls

In order to increase the general utility of their scrap reclaiming rolls, the Ajax Manufacturing Company, Cleveland, Ohio, has recently evolved a new rolling machine which, without changing the rolls, can be used for re-rolling rod scrap, longitudinal slitting, re-rolling arch bars and other flats, and rolling bundled or fagoted iron scrap.

The new model rolls possess the combined advantages of all previous models. Two main stands of three-high rolls are provided and a small stand of two-high splitting rolls capable of splitting various sizes of flats preliminary to re-rolling. The rolls are built in two sizes: A, 12 in. by 40 in. and B, 14 in. by 44 in. direct gear, motor driven by 100 hp. and 150 hp. motors, respectively.



Ajax Scrap Reclaiming Rolls as Recently Redesigned and Improved

The one main stand is equipped with rolls having Gothic roughing grooves for breaking down large bars or billets and fagoted iron scrap. The A mill has a capacity for $2\frac{1}{2}$ in. rounds or billets and $3\frac{1}{2}$ in. square fagots; the B mill will handle $3\frac{1}{2}$ in. rounds or billets and $4\frac{1}{2}$ in. fagots. The second main stand carries the finishing rolls, the grooving of which depends entirely upon the kind of stock to be produced. By placing as many roughing grooves as possible in the roughing rolls practically all the reduction can be effected in them and only two passes are taken in the finishing rolls to produce the proper size. This minimizes wear on the finishing grooves so that the stock runs true to size and the finishing rolls do not require frequent redressing.

Hollow Spindle Thread and Form Miller

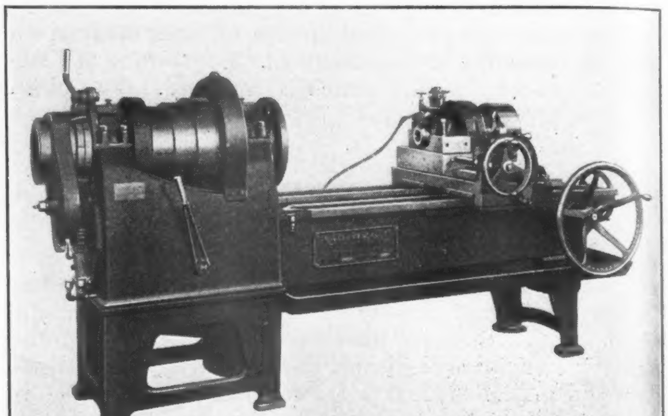
Designed to mill either internal or external, right or left hand, straight or taper, single or multiple threads of any form, the Smalley-General Company, Inc., Bay City, Mich., announces an improved hollow spindle thread and form miller. Special effort has been made to provide a machine as simple, efficient and reliable as possible, combining strength and accuracy.

The essential parts of the machine are evident from the illustration which shows the powerful cone pulley drive and the main spindle adapter to carry the work or chuck. The lead screw is connected with the main spindle by means of a change gear train. The main spindle is timed with the milling carriages by means of a patented clamping device. During the milling operation while the work makes one revolution, the milling head or carriages are moved back by the lead screw and clamping device a distance amounting to the pitch of the thread to be milled. The No. 23 machine, illustrated, has a swing of 20 in. and can be furnished with beds of various lengths. The "A" size machine has a distance of 2 ft. between the face plate and the milling spindle. The normal milling capacity is 13 in. outside diameter and 17 in. inside diameter. The length of external thread is ap-

proximately 5 in. depending on the pitch. The length of the internal thread depends upon the inside diameter; the larger the diameter, the longer the thread. It is not practical to mill absolutely square threads.

The No. 23 machine has a lathe speed bearing a constant proportion to every milling speed. The change from milling to lathe speed is obtained instantly by shifting the lever located on the head of the machine. Lathe work such as turning, boring and facing can be done at lathe speed. The advantage of this arrangement can be readily seen because with practically each thread there is an adjacent shoulder which must be normal to that thread. By throwing in the lathe speed the surface can be done at lathe speed at the same chucking, thus securing the desired alinement. It also saves an additional chucking operation. Tools for lathe work are located on the top slide, an auxiliary tooling slide being provided on the ways of the machine when desired.

The cross slide is controlled by means of a micrometer screw determining the diameter of the thread to be cut. The top slide carries the milling spindle which is driven through a three to one spiral gearing, thus giving it ample power and even torque. The bottom carriage when milling is clamped to the lead screw tube, located between the ways of the machine. Any kind of chuck suitable to the work in hand can be attached to the machine. By means of the lead screw tube, a thread can be started at any time or place, thus permitting the milling of interchangeable tapered threads. Production is increased because the operator does not have to wait for a split nut to come in contact, and wear on the lead screw during lathe operations is saved. With

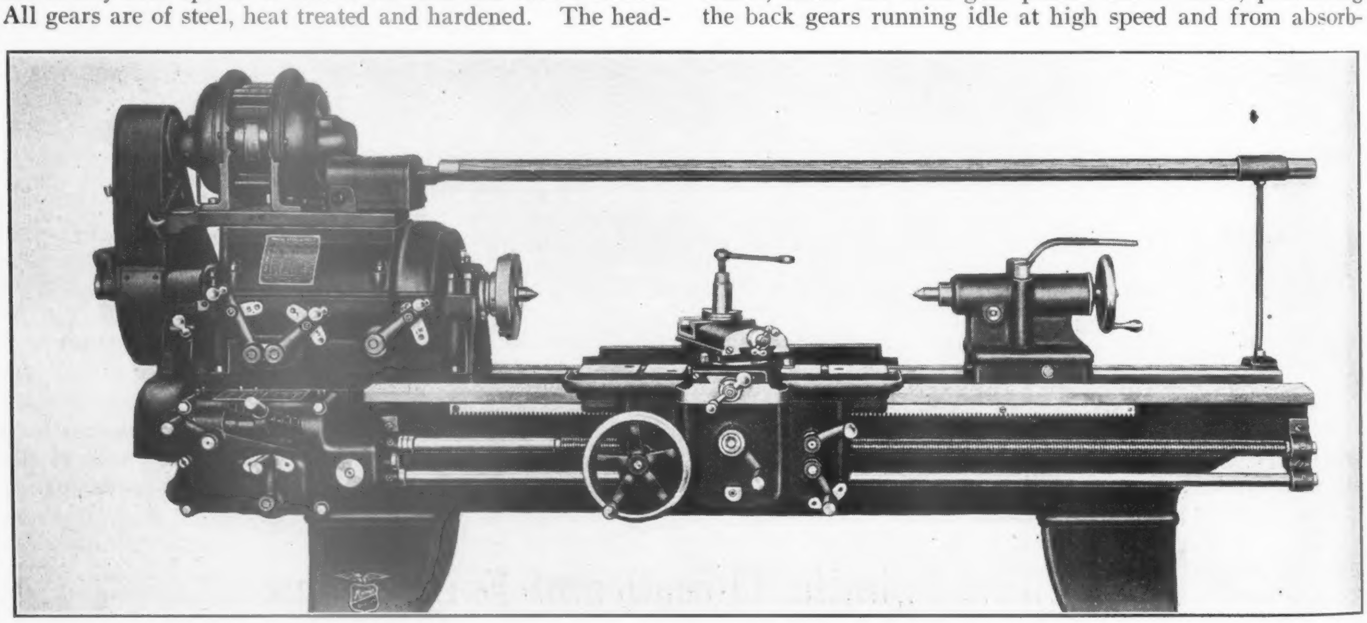


Smalley General No. 23 Thread Miller

attachments available the Smalley-General thread miller is adapted to mill rapidly and accurately all forms of threads and all sizes within its capacity.

Geared Head Lathe Made in Three Sizes

THE Morris Machine Tool Company, Cincinnati, Ohio, has placed on the market a geared head lathe made in 16-in., 18-in. and 22-in. sizes. Twelve spindle speeds are provided and, with a double friction countershaft, there are twenty-four speeds or twelve forward and twelve reverse. All gears are of steel, heat treated and hardened. The headstock is filled with oil up to a certain level permitting the gears to dip enough to be thoroughly lubricated by the splash system.



Morris Geared Head Lathe Made in 16-In., 18-In. and 22-In. Sizes

All speeds are secured through sliding gears and one positive back gear clutch, friction clutches or any parts requiring adjustment having been eliminated. The only friction clutch is in the pulley at the initial drive, which is of a large diameter, controlled by a shifter rod running the full length of the lathe. This permits the operator to start and stop the lathe from any working position. Speed changes are secured through the levers in front of the head. The two levers at the back end control a set of sliding gears giving six speeds. This lever, when engaging the direct drive clutch, slides the back gear pinion out of mesh, preventing the back gears running idle at high speed and from absorbing unnecessary power. When releasing the friction clutch in the pulley, a brake can be applied by the same pull which stops the idle rotation of the spindle. This is a great convenience both when shifting gears and when turning work partly around for inspection at different points on the diameter. The pulley is protected by a guard which can be swiveled to suit the angle of the belt.

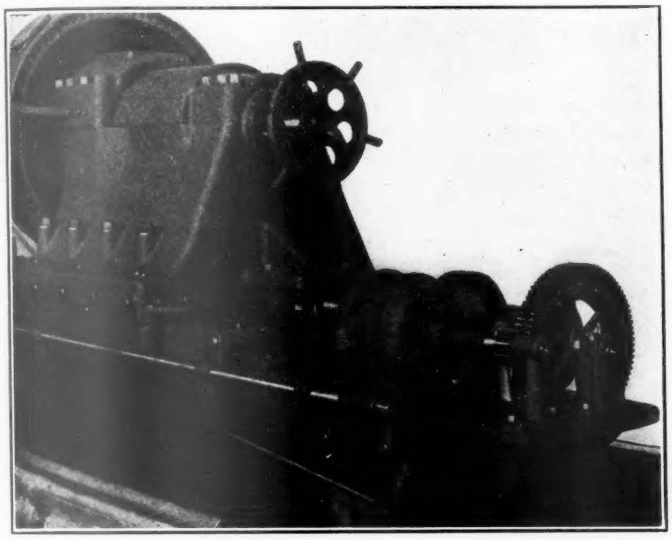
The Morris geared head is interchangeable with the cone head. All geared heads are arranged to receive the motor

drive unit at any time. The motor is mounted on a plate, bolted to the head and drives the clutch pulley by an endless belt which is furnished with the motor drive details. An idler pulley adjusts the tension of the belt by means of the star handle at the front of the motor plate. The idler pulley and bracket are mounted on the motor plate, making the motor drive unit self-contained.

The speed range is in geometrical progression from 12 to 347 r.p.m. for the 16-in., 10 to 297 r.p.m. for the 18-in. and 10 to 297 r.p.m. for the 22-in. machine.

Fifty-Four Inch Tire Turning Lathe

The Putnam Machine Works of Manning, Maxwell & Moore, Inc., Fitchburg, Mass., has extended its line of car wheel lathes to include a 54-in. heavy pattern machine for turning car, tender, and engine truck wheels. Wheels from 52 in. in diameter to the scrap limits of 30-in.

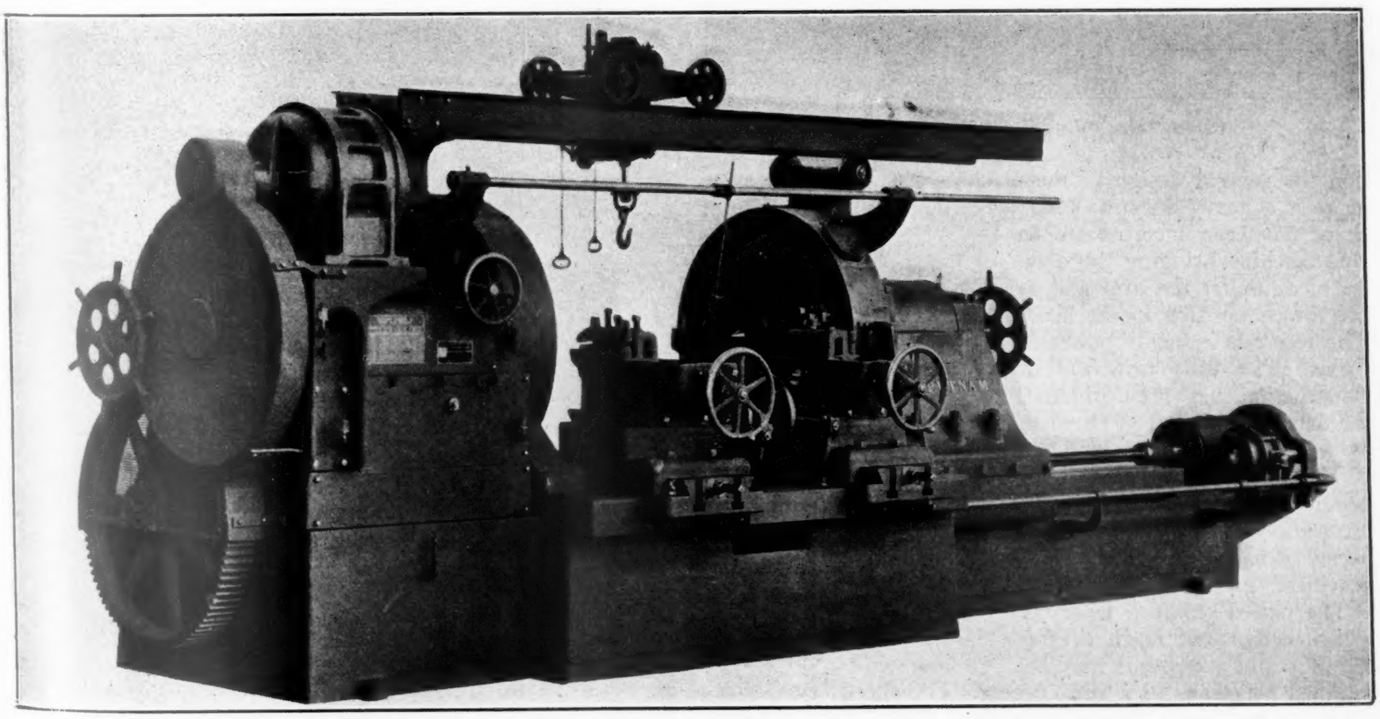


View Showing Tailstock Adjusting Mechanism.

wheels can be turned and a spindle nose capacity for chucking axles with journals as large as 10 in. in diameter by 16 in. long is provided. The machine is flexible and will handle not only standard but narrow gage equipment down to 3 ft. 6 in. gage.

The lathe bed is deep, strongly cross-tied with a solid top to keep out chips. An important feature from the standpoint of ease of operation is the patented tool slide arrangement, known as the combination tool slide, which permits of rough turning and finishing tires complete to contour without changing tools. Each tool block carries a roughing tool and full width forming blade mounted side by side. When the roughing tool has finished its work, the forming blade by a slight movement of the tool slide is in position to be fed in for the finishing cut. This feature saves considerable time and labor and the tools do not have to be handled or changed until they become too dull to cut. The forming blades are held in position by a friction clamp so that they may be readily changed in a few moments. The tool slides are of steel and the tool slide bases have hardened and ground steel plates fastened to their surfaces to minimize wear.

The tailstock is moved along the bed either by an auxiliary $7\frac{1}{2}$ hp. motor, or by an individual countershaft. The mechanism for this purpose allows the motor or countershaft to be started under no load, the control being a friction clutch and containing a relief which operates mechanically when the tailstock reaches a position where it is clamped. When the tailstock is in operating position, it is automatically clamped to the bed by a compensating clamp. In withdrawing the tailstock, when unloading, it is not necessary to reverse the direction of the motor. The headstock is permanently locked in like manner by the left hand tool block. The parts affected are tied together, so that the strains due to the cutting tools are self-contained within those parts;



Putnam 54-In. Lathe for Turning Car, Tender and Engine Truck Wheels

therefore, when the tailstock is run to and clamped in position, both it and the headstock are firmly locked to their respective tool blocks.

Both the headstock and tailstock main spindle bearings are bushed to facilitate maintaining the original accuracy of the spindle alinement. The internal spindles in the headstock and tailstock are controlled by spring pressure which automatically tightens the split chucking bushings which are slipped over the axle journals just prior to loading a pair of wheels into the machine. The end thrust, due to driving by serrated dogs, is taken by thrust collars located on the external spindles and running in a bath of oil. Spindles and face-plates are made in one piece. Each face-plate is equipped with four Putnam non-slip driving dogs. The maximum distance between the face plates is 10 ft. 9⅞ in., while the width of the faceplates, including the face of the ring gears is 12 in.

The machine is designed for three types of drive which are interchangeable: single pulley belt drive, constant speed motor drive, or adjustable speed motor drive. The general design of the headstock is the same for each type of drive, except that for the single pulley belt drive or the constant speed motor drive more gears are provided to give the necessary number and range of tire turning speeds. A lathe furnished with any one of these three drives may be readily converted into any of the other types.

A calipering attachment is furnished, which remains attached to the machine. When specified, the machine can be equipped with a pneumatic crane for rapidly handling wheels in and out of the lathe.

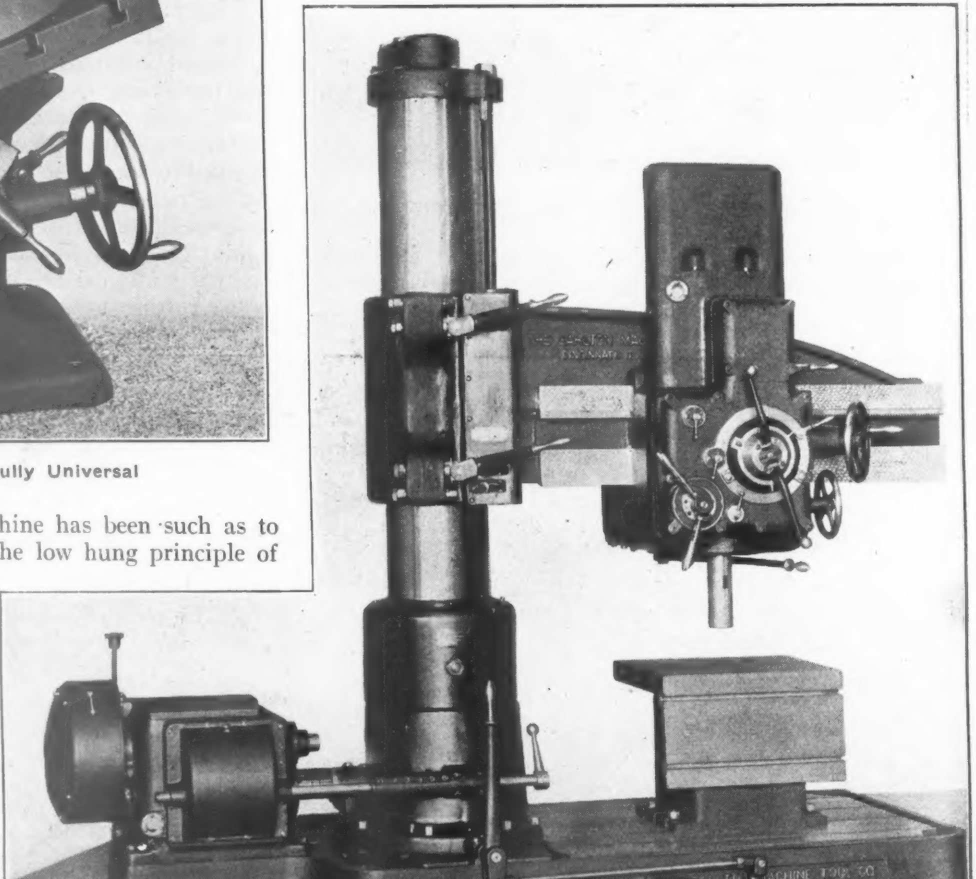
Ball Bearing Heavy Duty Radial Drill

ALL revolving parts of the new line of radial drills brought out by the Carlton Machine Tool Company, Cincinnati, Ohio, are equipped with high grade ball bearings to take both the radial and thrust loads. In addition the general design of the machine has been such as to make it a heavy duty machine. The low hung principle of drive has been incorporated in this machine bringing the driving gear under the arm and at the lowest position in the head. The result is a steady powerful drive. The unit principle of construction has been utilized, the driving and feed mechanism as well as the tapping and reversing attachment being independent units, assembled in an oil tight case on shafts, supported at each end in large ball bearings.

Round Table Which Is Fully Universal

The speed control lever is within convenient reach of the operator and six speeds may be obtained by means of a sliding gear. The speed box is connected to the stump knee by a coupling. Bevel gears running in a bath of oil carry the drive to the vertical shaft. Each gear is mounted on a sleeve or shaft supported on both ends by ball bearings. The arm is raised and lowered by means of a pair of bevel gears and a tumbler gear.

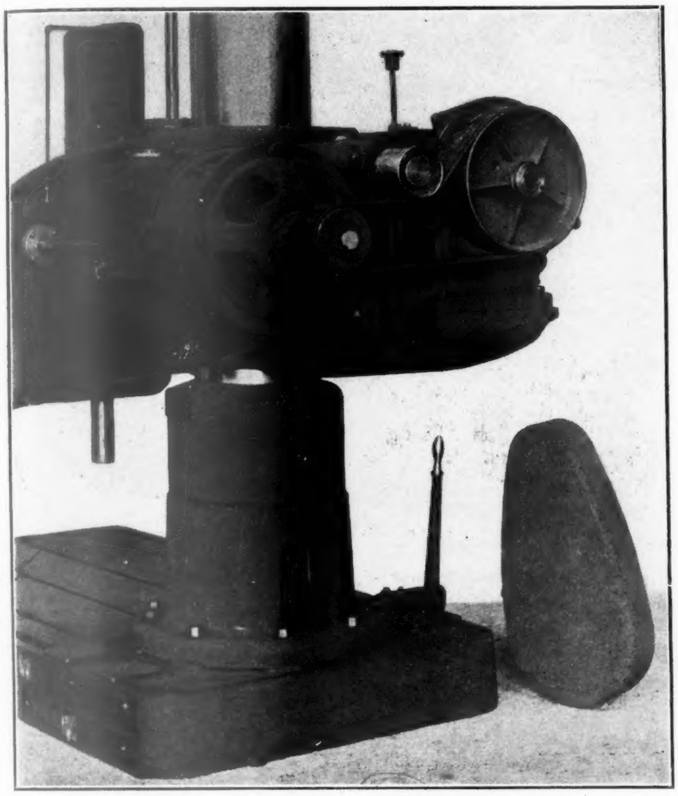
Control of the arm is by means of a lever on the bottom and this is inter-locked in neutral position when the arm is tightened to the column. The operator cannot engage operating gears without first loosening both levers. When the arm travels to the maximum height on the column it is stopped automatically by a plunger and when lowering, if it meets any obstruction, it is also stopped automatically. Neither the inner nor outer column is split. The locking mechanism is operated by a hand lever or foot treadle. The arm is



Carlton Radial Drill Arranged for Constant Speed Drive Through Gear Box

finished with long, flat ways affording a substantial bearing for the head, which is entirely enclosed and consists of sub units.

The sleeve for raising and lowering the spindle is mounted at the top of the spindle and balanced by a counter-weight

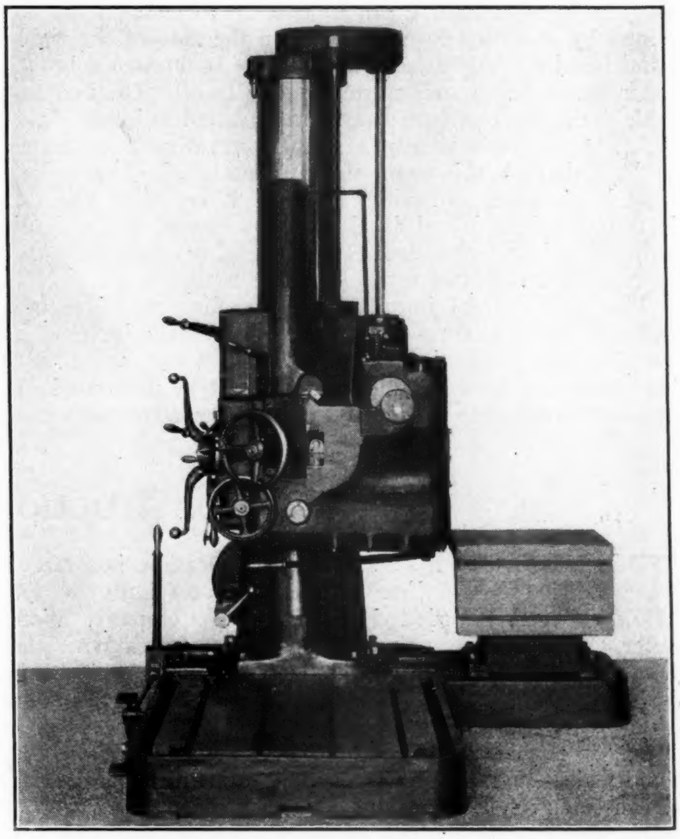


Belted Motor Drive Through Speed Box on Arm

that acts through the same pinion that works the rack for raising and lowering the arm. The spindle has an automatic kick-out for maximum travel up and down.

Power is furnished through a cone pulley, feed change gear box, constant speed drive through speed change gear box, or a variable speed motor mounted on the face and direct connected. This combination of motor drives can also be mounted on the radial arm if desired. The table wing is a separate unit and can be attached to the base at any time. The universal table is furnished as separate equipment and can be provided with a round table which makes it fully universal.

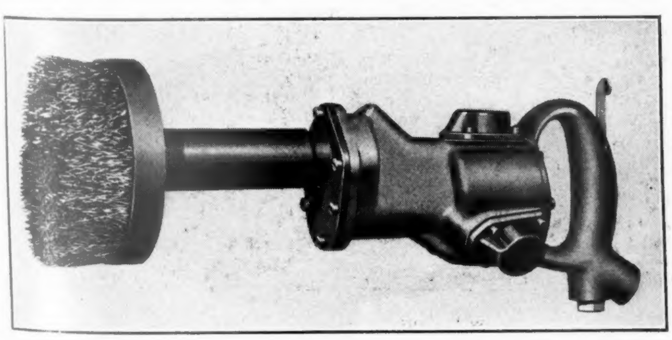
The Carlton radial drill is made in 4, 5 and 6 ft. sizes. It drills to the center of 8, 10 and 12 ft. circles and the maximum distance between the spindle and base is 5 ft., 5 ft. 6½ in. and 6 ft. 3½ in. respectively. The spindle feed in each case is 18 in., a Morse No. 5 taper hole being provided in the spindle. Twelve feed changes are provided arranging for .005 to .069 in. per rev. There are 24 speed changes available varying from 18½ to 800 r.p.m. The working surface of the table and base are 22 in. by 28 in. and 3 ft. 6 in. by 4 ft. 5 in., respectively. Five, 7½ and 10 hp. motors respectively, are required to drive the three sizes.



View Showing Massive Arm and Head, Plain Box Table and Wing

Wire Brush for Cleaning Metal Surfaces

WIRE brush cleaning of metal surfaces offers an opportunity for considerable saving of time and labor over that required by hand in removing paint, rust, scale and dirt. It has been difficult, however, to obtain a brush which would work effectively on an air motor and not wear out too rapidly. To overcome this difficulty, a 5-in. brush with special heat treated steel wires has been developed by the Ingersoll-Rand Company, New York. It is sturdily constructed, being designed to stand severe service and is used as an attachment for the No. 6 Little David drill. This drill has liberal bearings to take up all the end thrust, when pressing down on the work and the motor is reliable, operating at high speed. Overall dimensions are small and the brush can be used in sharp corners and other cramped spaces. The total weight is 11½ lb. The brush and motor outfit is adapted for removing paint, rust, scale and dirt from tanks, steel cars, structural steel and all sheet metal surfaces. It is also useful for cleaning iron, steel and aluminum castings, the small heat treated wire points getting into all corners, and removing particles of dirt hard to reach otherwise.



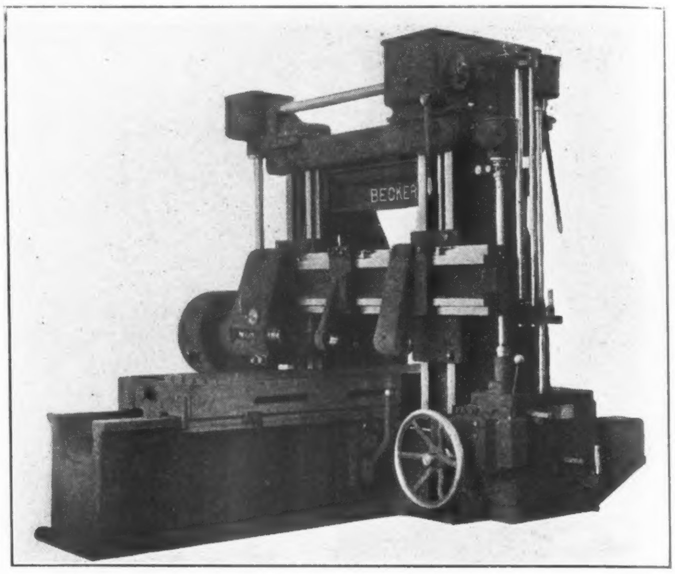
Heat Treated Steel Wire Brush Used with No. 6 Little David Drill

Heavy Planer Type Milling Machine

A LINE of planer type milling machines of the design illustrated is being built by the Becker Milling Machine Company, Worcester, Mass., in widths ranging from 24 to 48 in., and in lengths up to 20 ft. These machines are of heavy construction and are driven through a single-pulley gear box mounted on top of one of the housings. A clutch furnished on the driving pulley for starting and stopping the machine is operated by means of a lever conveniently placed on the operating side. On motor-driven machines, a similar arrangement eliminates the necessity of stopping the motor in order to stop the machine.

Hardened steel gears of the automobile transmission type are furnished and these run in oil. Speed changes are obtained by operating levers located on the side of the right-hand housing. The drive to the spindle is through a bronze worm wheel and a steel worm running in oil. The bed and table are of the box type, heavily constructed to insure rigidity. The table is driven by a spiral worm directly connected to the table rack, this worm also running in oil. The milling head has a hand and power traverse on the rail. The rail is counterweighted and is elevated by power, a fine hand adjustment being provided. This type of machine may also be furnished with two vertical milling heads.

The more general introduction of milling machines into railroad shops has resulted in a considerable increase in machine shop production, particularly when high speed milling cutters are used in a machine of the type illustrated. It has been possible to produce duplicate locomotive parts in a length of time which would have been considered incredible a few years ago. The Becker planer type milling machine is designed to stand up under the heaviest cutting feeds and speeds of which these high speed milling cutters are capable.



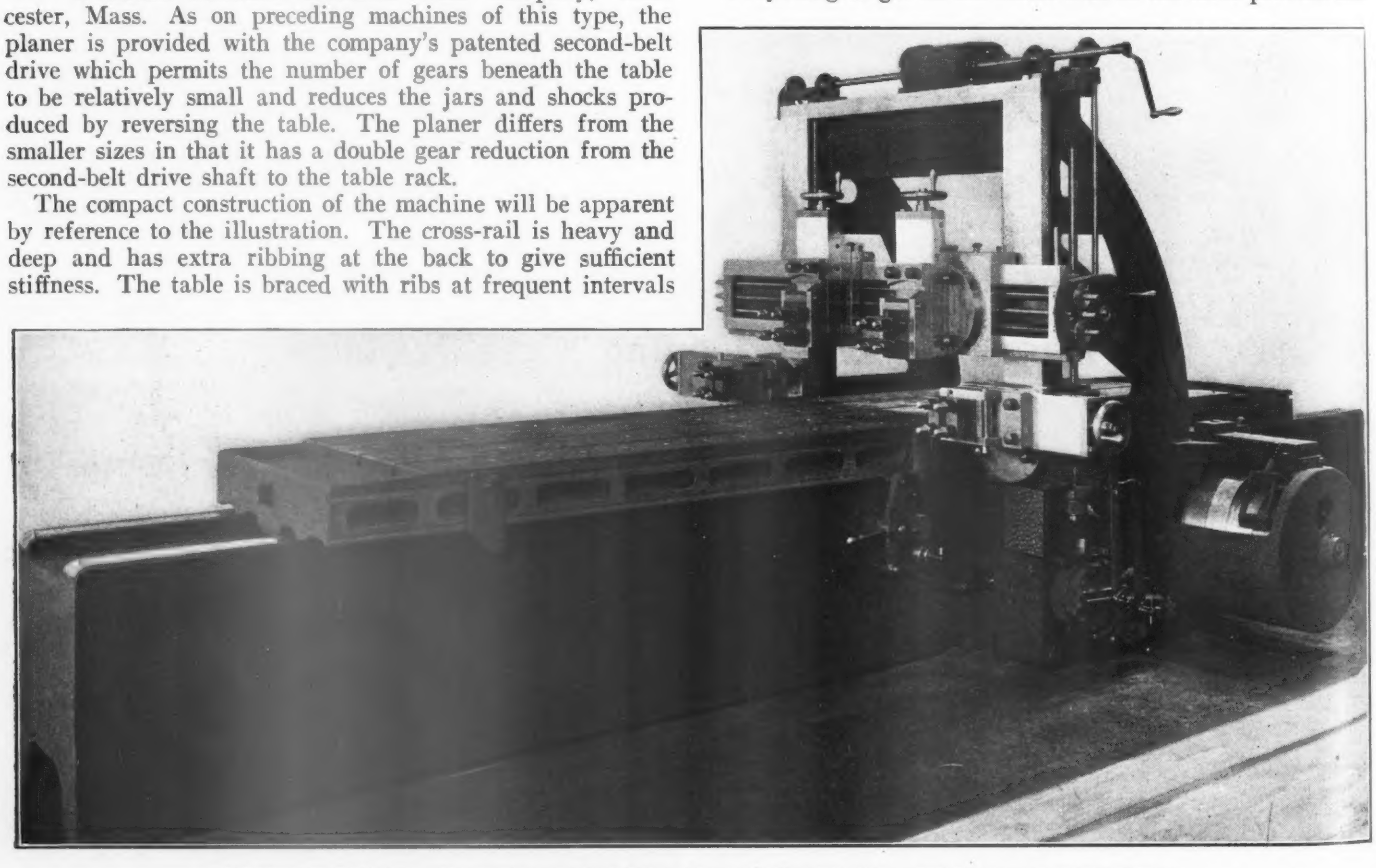
Becker Planer Type Milling Machine

Rugged Construction Marks New Planer

THE 32-in. planer, shown in the illustration, is a recent addition to the line of machine tools built by the Whitcomb-Blaisdell Machine Tool Company, Worcester, Mass. As on preceding machines of this type, the planer is provided with the company's patented second-belt drive which permits the number of gears beneath the table to be relatively small and reduces the jars and shocks produced by reversing the table. The planer differs from the smaller sizes in that it has a double gear reduction from the second-belt drive shaft to the table rack.

The compact construction of the machine will be apparent by reference to the illustration. The cross-rail is heavy and deep and has extra ribbing at the back to give sufficient stiffness. The table is braced with ribs at frequent intervals to guard against possibility of springing. The table T-slot for shipper dogs extends the full length of the table.

Projecting ledges on the under side of the table prevent the



Whitcomb-Blaisdell 32-In. Planer Combining Rugged Construction with Improved Table Drive

dropping of chips into the ways. The housings are of the box type, bolted to the bed and rigidly connected at the top by a heavy rail. The bed is cast with a solid top, the only opening being at the center where the double gear reduction is placed. This opening, however, is covered by sheet metal placed in such a way that only the upper segment of the bull gear projects through it. Casting the bed with a solid top serves two purposes, being a safety feature and preventing dirt and chips from entering.

The machine is equipped with a patented cross-rail binder which enables the operator to lock the cross-rail securely to the housings by operating a lever and without moving from his position on the working side of the machine. Patented self-locking shipper dogs are also a part of the regular equipment, it being only necessary for the operator to set these dogs for the required length of stroke. The principal dimensions of the machine are as follows: actual width between housings, 36 in.; planing height under cross-rail, 32¾ in.; length of table, 10 ft.; width of table, 28 in.; length of bed, 16 ft.; length of down feed, 13 in.; and minimum distance between centers of tool-boxes, 7¼ in. The approximate weight of the planer is 17,500 lb.

Improved Tools for Machinists and Toolmakers

SEVERAL new and improved tools of value to the machinist and toolmaker have been added to the line made by the Brown & Sharpe Mfg. Co., Providence, R. I. Among these is a depth gage (Fig. 1) primarily important because of its simplicity and accuracy. It is furnished complete with three measuring rods and enables readings from 0 to 3 in. to be obtained by thousandths of an inch, the micrometer screw having a movement of 1 in. The desired rod is easily placed in position by removing cap *A* (Fig. 1), which permits the rod in the gage to be withdrawn and the one desired inserted. Replacing cap *A* brings the shoulder on the rod against a finished seat. The shoulders on the rods are adjustable and permit individual adjustment of any rod. The tool is obtainable with either a 2½ in. or 4 in. base. The same adjustment for wear on the threads is used as is provided on standard Brown & Sharpe micrometer calipers.

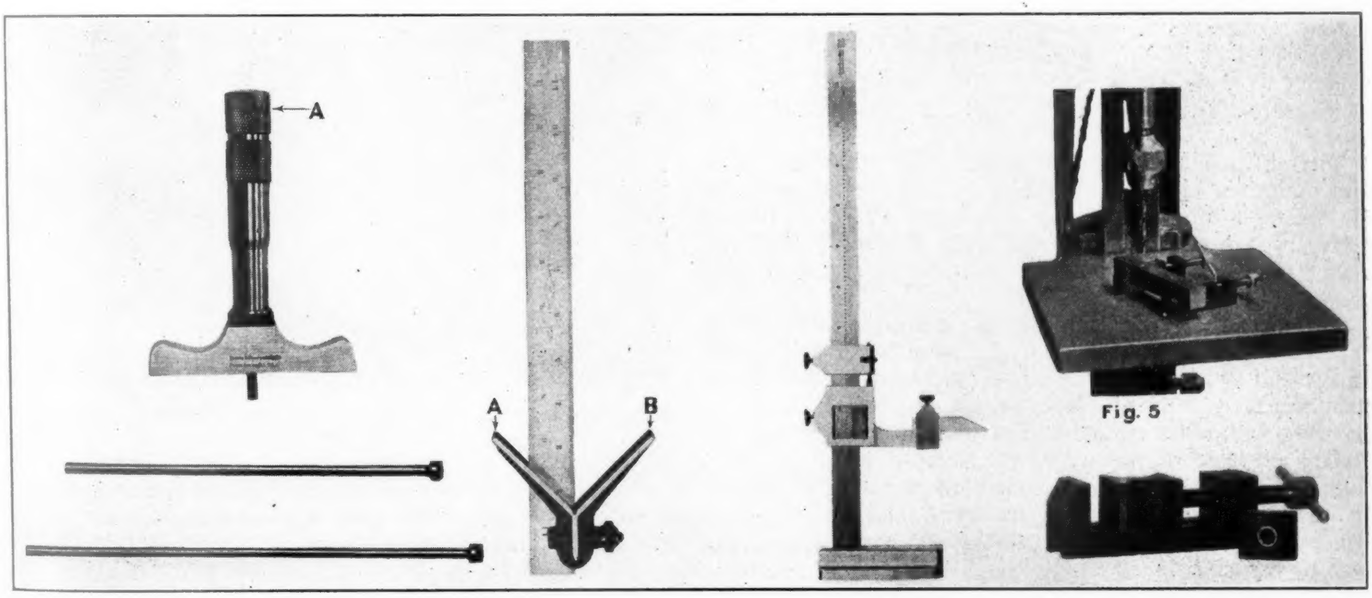


Fig. 1 Fig. 2 Fig. 3 Fig. 4

Recent Additions to the Line of Tools Made by the Brown & Sharpe Mfg. Co.

An improvement has also been incorporated in the combination squares and sets furnished with centre heads. The centre heads are now ground so that both arms are of equal length and the points *A* and *B* (Fig. 2) are both equidistant from the edge of the scale. This permits the use of centre heads with work of large diameter. The provision of nearly 250 different combination squares and sets affords a broad choice.

A new vernier height gage is shown in Fig. 3. The base is proportioned to give rigidity without undue weight and extends beyond the back of the bar, affording additional stability. The gages are made in two sizes. The 10-in. size can be furnished in either English or metric measure to take inside and outside measurements. It is also made as a combination gage reading to English measure on the front and to metric measure on the back. The 18-in. gage takes measurements outside the jaws. The bar is graduated to read, by means of a vernier, to thousandths of an inch or fiftieths of a millimeter as the case may be, the graduations in each case being carried far enough along the bar to allow measurements to the full rated capacity. The readings with the English measure or metric measure gage are direct and easily legible.

A new vise for toolmakers and mechanics (Fig. 4) is reliable and handy for use in drilling, fitting and laying out work on surface plates. It is case hardened and the base is ground. A large jaw, provided with a tongue which slides in a groove in the base, is held in place by a strap. This feature enables the vise to hold the work firmly and prevents the jaw from lifting. The strap can be removed and by using the jaw upside down, taper pieces can be held in the tool. The greatest capacity of the vise is 2 in. The V-groove in the under side of the base takes work from 9-32 in. to 11-16 in. diameter and thus adds to the handiness of the vise since it can be used as a V block. Each vise is furnished, with two steel jaws which slip on and off the screw to provide for a greater range of work. Fig. 5 shows a pair of vises holding two strips to be drilled with a half hole in each strip, an operation for which the vices are well suited.

Electric Grinder and Buffing Machine

THE United States Electrical Manufacturing Company, Los Angeles, Cal., has recently completed the development of a heavy duty electric grinding, buffing and polishing machine. While originally designed for buffing pneumatic truck tires and having an approximate over-all shaft length of 6 ft., the machine is built in a number of different sizes and can be used for many grinding and buffing operations in railway shops.

The spindle of the machine is mounted on standard Hess-Bright ball bearings, which are lubricated by running in a bath of oil. Two of these ball bearings are mounted on the shaft close to the wheels, thus reducing vibration to a minimum. A third ball bearing is located at a proper distance from the other two in order to eliminate periodical vibration which, while not always evident, will cause ball bearings to wear and become loose after being in use only a short time. The diameter of the spindle is 1½ in.

The rotor of this grinding machine is designed and built in such a way as to make it practically indestructible. The rotor bars are brazed to the end rings, making an electrical and mechanical joint that cannot be destroyed except by intense heat, hot enough to melt the copper.

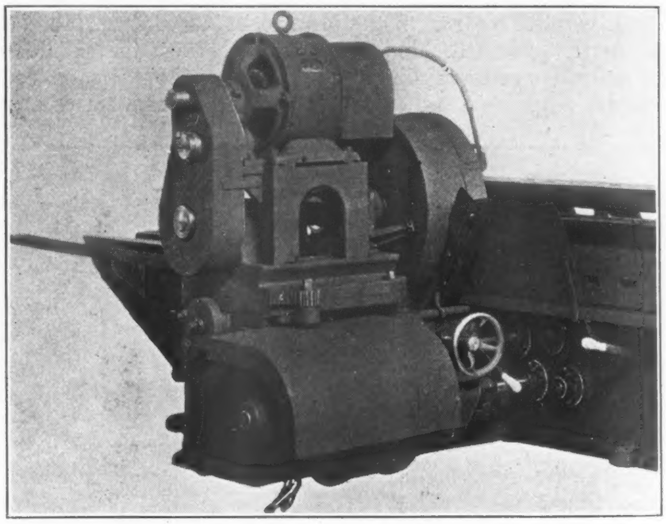
The bearings and windings are entirely enclosed in dust-proof housings to prevent any emery, grit or foreign matter from getting into them. The 5 hp. machine, operating at 3,600 r.p.m. is the most popular size and owing to the combination buffing and grinding feature is a valuable time saver in shops where both operations have to be performed.

Heavy Duty Reversing Motor Face Grinder

ENTIRELY self contained, the heavy duty grinder illustrated is operated by three motors; one 15-hp. motor for driving the wheel; one variable speed 5-hp. reversing motor for driving the table traversing mechanism, and one ½-hp. motor for driving the pump. The variable speed motor provides a table speed of 7 to 27 ft. per min. and the reversing feature of the motor eliminates all belting. In operation, the machine is controlled from either the front or rear by mechanical means and is also provided with a push button for controlling the motors. The machine, illustrated, has a wheel 24 in. in diameter and has a capacity to grind work 12 ft. long. It is made in different lengths, however, varying from 6 ft. to 17 ft., the weight of a machine of 12 ft. capacity being 14,750 lb.

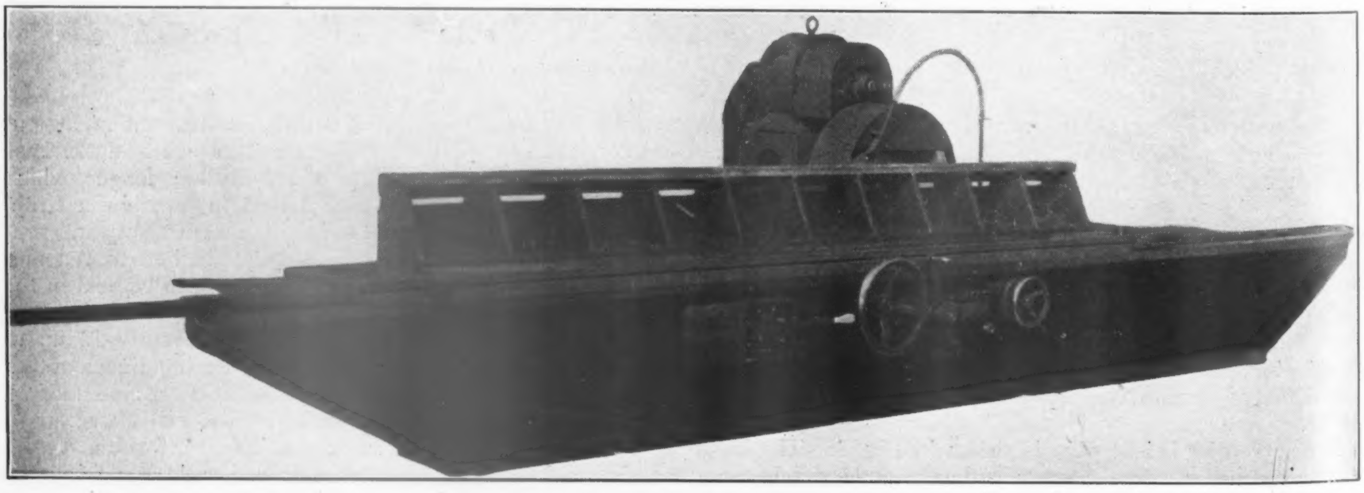
The advantages of separate motor drive for wheel, table and pump are numerous, perhaps the most important being the greater flexibility in design obtained. There are no unnecessary, power consuming and often dangerous belts and gear trains where individual motor drives for machine parts are used.

This machine can also be furnished with a swivel knife bar making it suitable for grinding large paper and veneer knives and by removing the angle bar shown, it becomes a standard face grinder, adaptable for use on all kinds of grinding within its capacity. The most modern practice of bearing construction, known as the sleeve flange type, is included in this grinder. Bronze bushings are used which can be easily replaced in case of wear and the original alinement not disturbed. The machine, as shown, is arranged for wet grinding and ample provision is made to take care of the spray and drainage. Provision is also made (as shown in the rear view), for swiveling the wheel head by means of



Rear View Showing Motor Drive and Arrangement for Swivelling Grinding Wheel Head

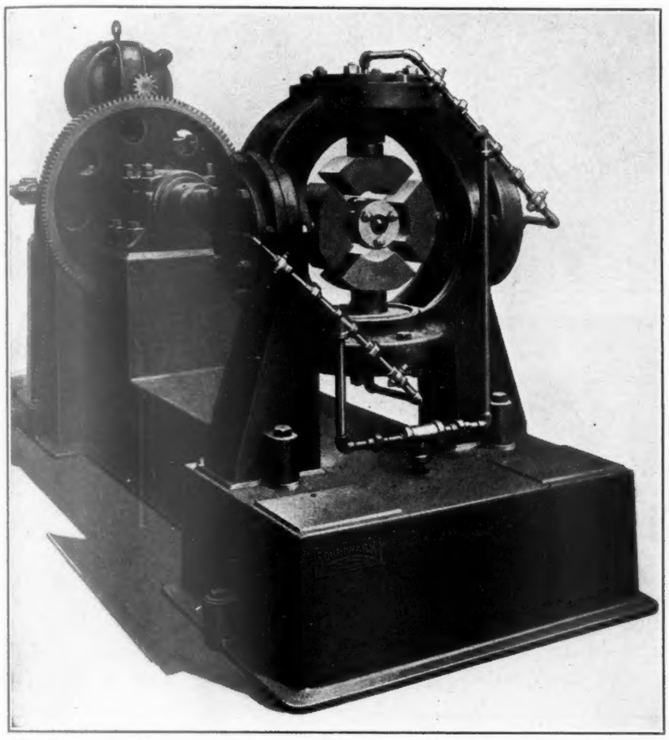
a rack and pinion, so as to permit of grinding either straight or concave, as may be desired. The machine is made by the Springfield Manufacturing Company, Bridgeport, Conn.



Face Grinder Which Is Entirely Self-Contained, Being Driven by Three Individual Motors

Universal Flue Welding Machine

PERHAPS the most distinctive feature of the universal flue welder manufactured by the Southwark Foundry & Machine Co., Philadelphia, Pa., is the fact that it welds the flue on the inside thus making the inside diameter at the weld the same as throughout the flue. This allows a free passage of gases especially in superheater flues, also eliminating the possibility of superheater units sticking in application. The machine is built sufficiently heavy to weld large flues and it takes safe ends of lengths from 6 in. to 4 ft. 6 in. Among the advantages claimed for the machine are relatively small power consumption, closeness of the furnace to the welding head, and a single foot valve controlling all operations.



Front View of Southwark Flue Welder with Heat Deflector Removed

Referring to the ilustration the clamping head at the front and the driving mechanism at the back are the two main parts of the machine. Mounted in the clamping head are four air cylinders, arranged for the heads to be removed from the outside. The front ends of the piston rods are equipped with sectional dies to clamp the outside of the flue at the weld. Running through the center of the machine longitudinally is the welding mandrel which fits the inside of the flue. Three rollers are assembled in the body of the mandrel which is hollow. Tapered and free in their bearings, they can be moved radially by inserting the paper mandrel that reaches through the middle of the spindle from the back of the machine. This mandrel is operated by an air cylinder controlled by the foot valve. The unusual length and weight of the safe ends, applied to superheater flues make it desirable to support them while being heated and it is customary to rig up the front of the machine with some type of roller table to support the long flue.

In operation the four clamping cylinders are piped to a single air line and arranged to operate simultaneously with the opening of the single foot valve. This valve is usually placed in front of the furnace on the left hand side, the position, however, being determined by the convenience of the operator. The timing of the different operations is controlled by the piping to the foot valve, so arranged that the clamping head first comes in on the outside of the weld; the jaw clutch which rotates the mandrel is next engaged; and last, the expanding arbor is forced into the center of the three rolls which, being in rotation as part of the mandrel, works the weld out against the clamping dies or anvil.

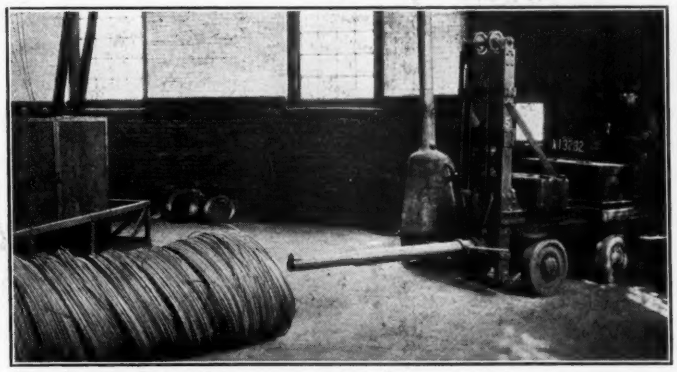
The furnace which should be of the oil burning type is mounted in front of the welding head so that the safe end is supported on the end of the welding mandrel, and a minimum amount of movement of the flue is necessary when passing to the welding position after the proper heat is obtained. The time required for the actual rolling of the weld is from six to eight seconds. The total time of making the weld depends upon the size of flue which in turn determines the length of time required for obtaining the welding heat.

Electric Truck Equipped With Carrying Ram

THE illustration shows an electric storage battery truck made by the Baker R & L Company, Cleveland, Ohio, the truck having been recently equipped with a carrying arm or ram which may be elevated or lowered as desired. This feature of the truck was originally developed to enable it to handle the large numbers of heavy iron cores and tire moulds used in the rubber industry. Since each of these moulds weighs several hundred pounds, it is difficult to handle them without machinery but by means of this truck they are readily moved from place to place as desired.

The truck is sometimes used for carrying coils of wire, as illustrated, in which case the truck is advanced with the carrying ram at the proper level to insert in the inclined pile of coils. The carrying ram is then elevated and lifts the coils from the floor when they can be moved to their desired destination and placed in racks or hung up on pegs. Although developed for the rubber industry alone, this truck has shown that it has quite a wide application, being adaptable to handling material in railroad shops and storerooms.

The mechanism of the truck consists of a carriage mounted on rollers running vertically between channel guides and lifted by an electrically driven cable hoist. The hoist motor is controlled by a small reversing switch, mounted on the dash and its operation in both directions is limited by suitable switches. The truck has a capacity to raise and support a weight of 2,500 lb. when spaced evenly on the ram.



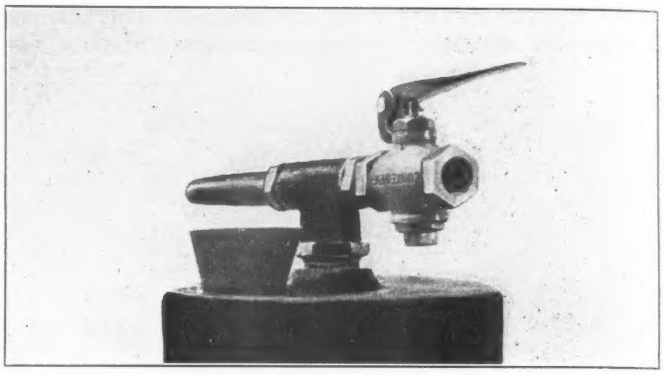
Baker Truck Equipped with an Elevating, Carrying Arm

Portable Device for Sand Blasting

IN both electric and oxy-acetylene welding it is important that the parts to be welded be thoroughly cleaned before the welding operation is started. All rust, scale, oil, sand, etc., should be carefully removed. It is also necessary to remove the scale and oxide from the deposited metal from time to time as the weld progresses so as to avoid slag inclusions between the layers. This cleaning work has generally been accomplished by a hammer and chisel or some kind of roughing tool but considerable time can be saved and a better job secured by means of a sand blast. This does not polish the scale on a weld but tends to remove it. A portable sand blast device for this purpose, as illustrated, has been placed on the market by the Transportation Engineering Corporation, New York.

The sand blast consists of a heavy sheet metal tank of about four quarts capacity, provided with a filling hole and an air-operated syphon. The syphon consists of a sand pipe, extending to the bottom of the tank, a pipe tee, an air nozzle, and a sand nozzle. The sand nozzle is case-hardened and is provided with a renewable tip, a trigger valve controlling the blast of sand. An air hose with a 3/8 in. nipple is attached to the open end of the valve, after which the sand blast is ready for use. An air pressure of from 75 to 100 lb. is required for the most efficient operation of this device and a uniform pressure is desirable.

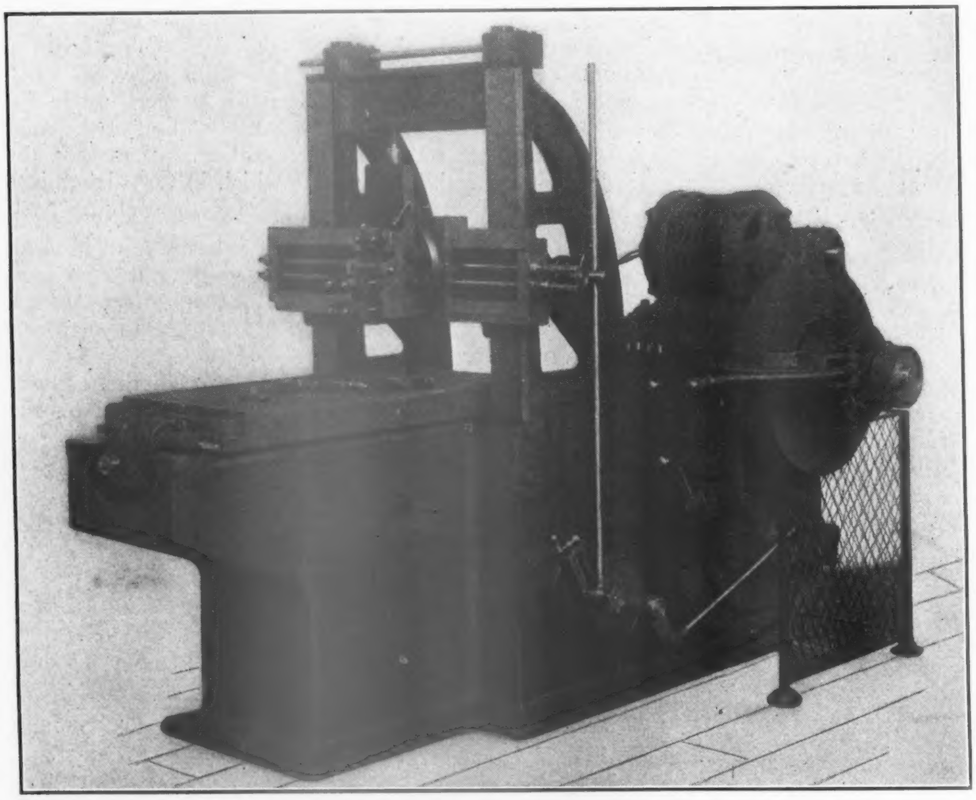
It is claimed that the sand blast will quickly and effectively clean the parts to be welded and also the weld itself, and that it will do this work considerably faster and more thoroughly than is possible by any other means.



Portable Sand Blasting Device Cleans Metal Parts Before Welding

Motor Drive Applied to Crank Planer

FOR many classes of work the crank planer is superior to either the shaper or belt shifting planer. It combines the rigidity of the planer and characteristics of the shaper, including ability to plane to a line and take the short rapid strokes necessary for short work. The 24 in. by 24 in. by 24 in. crank planer, illustrated, is made by the Woodward & Powell Planer Company, Worcester, Mass., and is particularly adapted to heavy railroad shop work, such as machining die blocks, rod straps, gibs, shoes, wedges, cross-heads, and slide valves.



Woodward & Powell Crank Planer Equipped with Motor Drive

The bed, housings, and cross rail are massive and well ribbed, thus making the machine rigid. The table has large bearing surfaces on the top of the bed, and is gibbed its full length.

The stroke is adjustable for length by a removable crank operating a screw in the crank disc. Any length of stroke up to 24½ in. can be taken over any portion of the table, the position of the stroke being adjusted by means of a shaft on the front end of the table. This adjustment can be made while the table is in motion. The planer can also be furnished with a stroke of 28½ in. if desired.

The housings are lipped on the bed and carried down on the sides of the bed, a construction promoting strength and rigidity. The arch rests on top of the housings as well as between them. The head itself is of practically the same design as those used on previous 24 in. planer models and can be swiveled to either side for angular planing, being graduated in degrees. The cross rail gibs are secured by nuts upon studs, threaded into the rail. The rail screw and rod are squared for the use of a crank at both front and rear ends.

The saddle is lipped over the cross rail and has packing at the top and back of the rail.

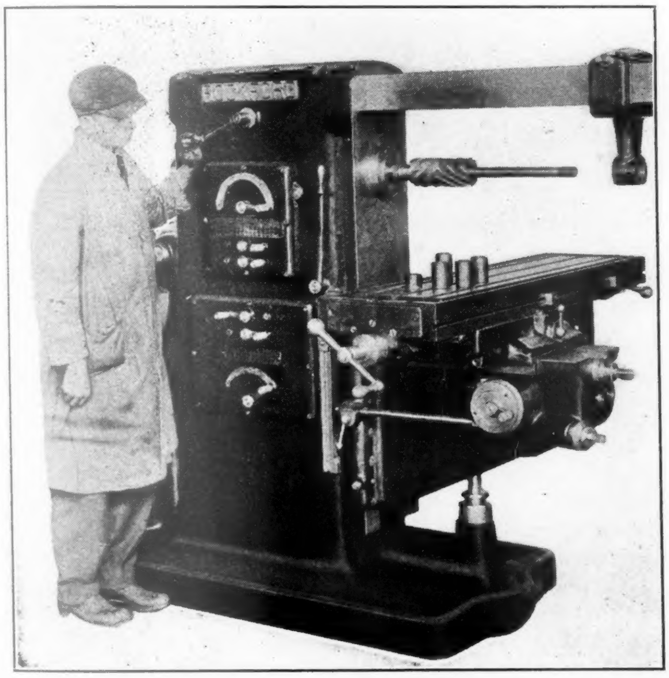
The feeds for cross, vertical, and angular travel are oper-

ated automatically by power or by hand and, taking place on the return stroke, do not require a longer stroke than is necessary for the cut. The machine can be operated by one pulley connected to a four-speed gear box, or a motor mounted on top of the gear box. Provision is also made for a four-step cone pulley drive in place of the gear box, if desired. The handle for operating the starting and stopping clutch of a gear box driven planer also operates a brake for stopping the table when the clutch is thrown out. All gears and revolving parts are thoroughly guarded by sheet metal cases or wire netting as illustrated.

Work 24½ in. long can be machined on this planer, the height to cross rail and distance between housings being 25 in. Ten, 17, 29 and 48 strokes per minute can be obtained and the ratio of return to cutting speed is 1.4 to 1. A 5-hp. motor is required to furnish driving power.

Milling Machine With Rectangular Overarm

THE Rockford Milling Machine Company, Rockford, Ill., has combined the advantages of previous machines in a No. 3 high power, all geared miller with several new features. The overarm is rectangular in shape, being actuated by a rack and pinion; the speed drive to the saddle



Rockford No. 3 Milling Machine with Rectangular Overarm and New Table Feed Mechanism

and table mechanism has been redesigned to eliminate the telescopic feed shaft and universal joints; and feed and quick return have been combined under a single control. In the new machine, feeds are changed by means of sliding gears instead of the tumbling gear previously used.

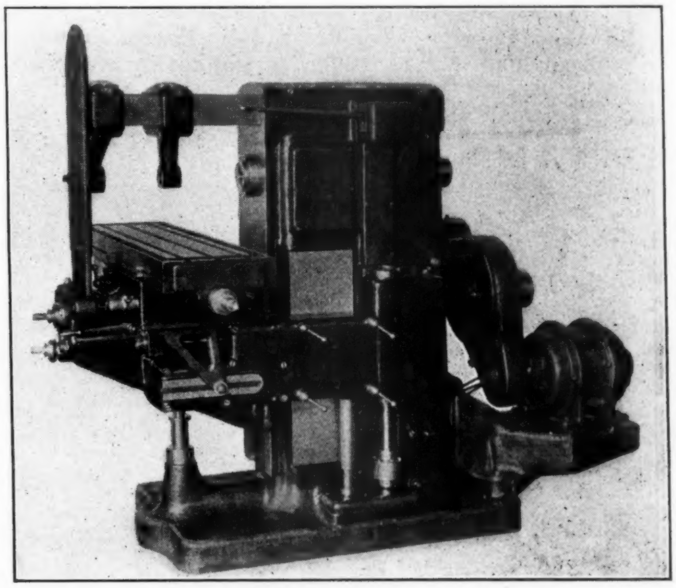
Constant speed drive is secured by means of a 10-hp. motor running at 320 r.p.m, arrangement being made for reversing the main spindle drive. Three levers manipulate all speed variations which are 16 in number varying in geometrical progression from 16 to 422 r.p.m. Twelve feeds are furnished, the range being from 1½ to 16 in. per min. In this case also three levers are used to obtain the feed changes which are plainly indicated on the feed plate.

The overhanging arm is a rectangular cast iron section ½ by 9½ in. It is clamped to the column by means of two securely locked eccentrics. When changing cutters, the eccentrics are loosened and the overhanging arm can be moved out beyond the arbor. The overarm brace is readily removable by loosening the bolt which fastens it to the knee. The center of the spindle is 7¾ in. below the overhanging arm and the maximum distance from the column face to the brace is 25½ in. The working surface of the table regularly furnished with this machine is 15 by 55 in., the range of feeds being 34, 12 and 20 in.

Combination power quick return and feed control is obtained by means of a gear box located on the upper right hand side of the machine. The long lever shown in the illustration controls the table movement. To move the table towards the left the lever is shifted from the center position towards the column and downward. To reverse the movement of the table, the lever is shifted upward into the opposite station. Cross and vertical feed is taken care of in a similar manner, thus enabling the operator to have constant control of whatever feed is engaged. This same lever also controls power quick return for the feeds in all directions.

The knee has the usual long bearing on the column, additional stiffness being provided by means of a heavy support of brace to the column. Both the knee and saddle are arranged to be securely locked and held rigidly when taking heavy cuts. A safety stop for all feeds is provided which acts whenever the load is too heavy, thus eliminating danger of breakage.

A vertical milling attachment can be provided and used without removing the overarm. The plug on the face of the



View Showing Motor Drive Arrangement

column under the overarm, when removed, exposes the bull drive gear into which is inserted the geared drive shaft for the vertical attachment. By clamping the vertical attachment to the extreme end of the overhanging arm as well as to the flanges of the column, the attachment is in position for operation.

The floor space required for the machine is 126 in. parallel with the spindle and 116 in. at right angles to the spindle. The machine has a net weight of 7,270 lb.

Double Annular Ball Bearing Floor Grinder

THE fact that the No. 3 electric grinder and polishing lathe, illustrated and made by the Glow Electric Company, Cincinnati, Ohio, is totally enclosed makes it especially adaptable to use in railroad shops, most of which are extremely dusty and dirty. The machine is made fully enclosed and dust proof and there is practically no possibility of abrasive dirt or dust getting into the bearings. External grease cups or oil gages have been eliminated and the oil wells are filled with a special evaporated oil which insures adequate lubrication for a period of at least a year. The recharging of the oil wells is a simple matter and in some cases the original supply of oil has lasted for almost two years.

The machines are driven directly by alternating current or direct current motors running at 1800 r.p.m. These motors are so designed as to take care of large overloads with small temperature rise. Two annular ball bearings (without a filling slot) of large diameter, having a spacing sleeve between, are used on each side. The bearings are of such a size as to withstand double the load for which the wheel is rated.

The inside wheel flange is keyed to the shaft with a Woodruff key, only a small clearance being allowed and this prevents dust from getting into the bearings, or oil from getting out. There is another dust collar between the inside flange and the other ball bearing, thus affording additional protection. The symmetrical contour of the frame gives large clearance and makes the machine easy to keep clean. Adjustable work rests are provided as shown in the illustration.

The 3, 5 or 7½ hp. sizes are furnished for floor mounting with standard starters or switches concealed inside the pedestal as standard equipment. These same sizes can be fur-

No. 3 Electric Grinder and Polishing Lathe

nished with push button controller if desired. In the smaller sizes the switch is mounted in the frame of the motor.

Single and Double Spindle Threading Machines

TWO new threading machines, brought out by the Eastern Machine Screw Corporation, New Haven, Conn., embody high rates of production and quality of the work.

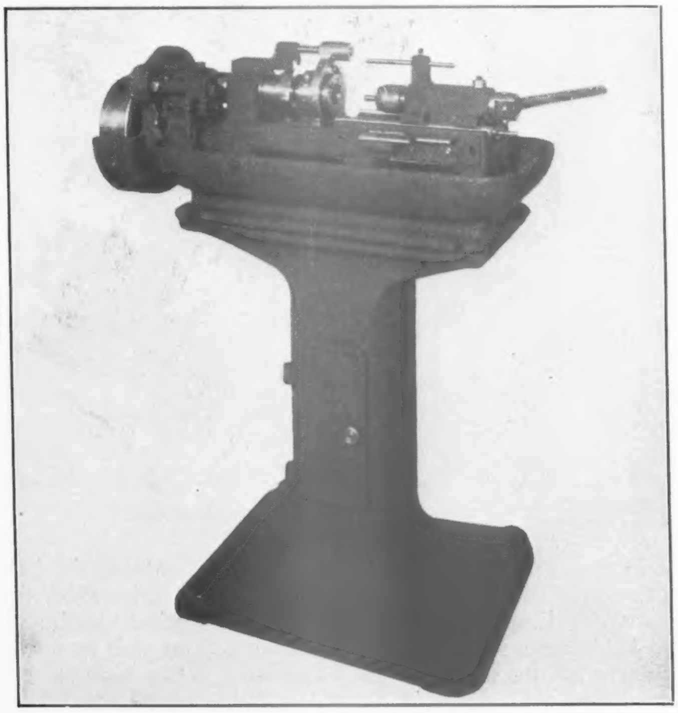


Fig. 1—H & G Single Spindle Threading Machine, Model SS

Special features include hardened and ground spindles and round tool steel ways with bronze bearings, easily replaced when necessary. The design of the slides is such that the piece threaded is held low and near the slide bearing. This does away with cross strain and cramp and makes accurate alinement possible under all conditions.

Although designed with liberal margins of safety the machines are relatively small and compact for the range of work and rate of production of which they are capable. Only a relatively small floor space, therefore, is occupied.

Single Spindle Model SS Machine

The small bench threading machine has been recently re-designed, as illustrated in Fig. 1, with the purpose of improving its appearance and durability and enlarging its range of work. This machine may be obtained either as a bench machine or equipped with a cabinet base. The bench space taken up in the former and the floor space in the latter are small. The slides while regularly equipped with spring collets may be furnished with an open side jaw where the shape of the work is such that this method of holding is more desirable.

An automatic stop provides for holding the work at the same point with each piece threaded and an easily adjustable tripping arrangement insures the proper length of threading cut on each piece. An interesting feature in connection with the open side jaws is that the operator will use only one hand to close the jaws, feed forward the work, draw back the work and open the jaws. Equipped with a pump which may be instantly made right or left hand, the machine is capable of threading either right or left hand threads by simply changing chasers and reversing the belt. The hollow ground spindle permits threads to be cut up to 9¾ in. in length whereas the side open jaws provide for holding stock of any length required.

Production with this machine should range from 300 to

1,000 pieces per hour, depending upon the class of work, and it can be operated with practically unskilled labor. The machine is equipped with H & G die heads and will accommodate any size of head up to 1¼ in. capacity, cutting pitches as coarse as 11.

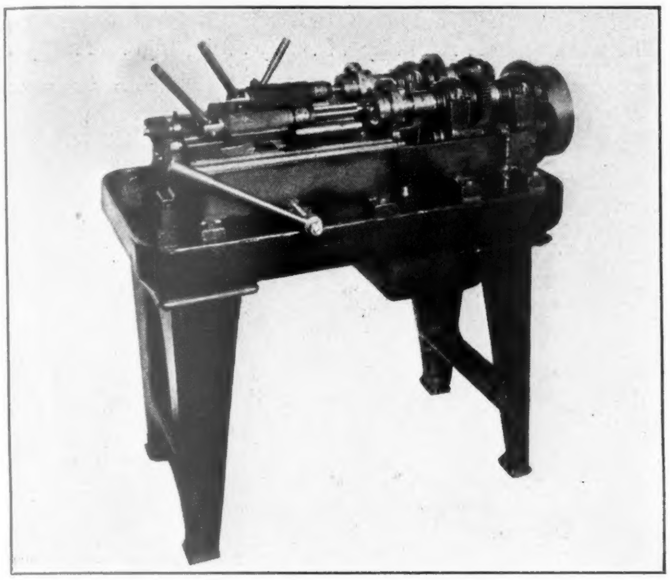


Fig. 2—H. & G. Double Spindle Threading Machine, Model DS

Double Spindle Model DS Machine

To provide a threading machine of greater capacity and maximum rate of production, the double spindle H & G threading machine illustrated in Fig. 2 has been developed. The different gear ratios make it possible to operate always at the most efficient speeds and with one operator handling two spindles the cost of threading is reduced to a minimum. The height of the machine from the floor to the spindle is 38 in., the overall length and width being 45½ in. and 29⅜ in., respectively, and the gear ratios are 9:1, 6:1, 3:1, 1½:1 and 1:1. The bearings are of bronze tapered and readily adjusted. Take-up bushings allow for wear of the spindle. Hardened round tool steel ways are provided; also bronze bearings in the slides. The pump (chain driven) runs at one speed regardless of the spindle speed: oil is pumped through the spindle into the die head. A 10-in. diameter pulley carrying a 3-in. belt drives the machine. Slides are regularly equipped with spring collets and are moved by a lever through a rack and pinion. They are designed so that any form of work holder may be readily attached. Open side jaws with an automatic stop for the length of work, to be operated by one lever for each slide, may be furnished. The machine will cut any thread within range of the 9/16 in., 1 in., 1¼ in. or 1½ in. H & G die head used.

Twenty-One Inch Heavy Duty Upright Drill

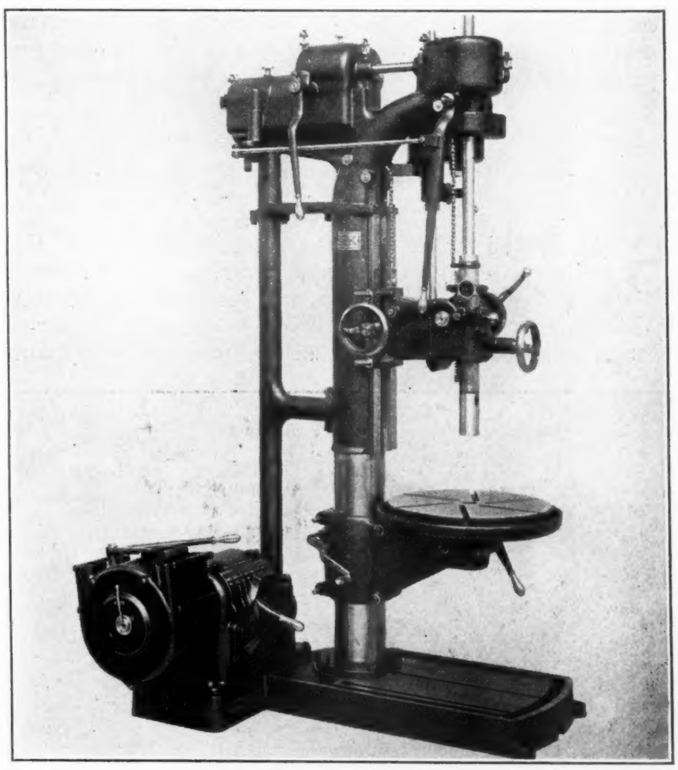
THE Fosdick Machine Tool Company, Cincinnati, Ohio, announces an addition to its line of drilling machines in a new 21 in. heavy duty drilling and tapping machine. This drill is of unusually massive proportions and will drive a 2½ in. high speed drill through steel and a 3 in. pipe tap in cast iron. The machine is ordinarily driven by a constant speed belt to tight and loose pulleys on the speed box. This gives a wide range of speeds at the spindle arranged in geometrical progression from 49 to 550 r.p.m., suitable for driving all sized drills from 3/16 in. in diameter up to 5 in. for boring.

Large numerals over each position of the speed changing lever indicate the revolutions per minute of the spindle, while the corresponding metal plate on the head indicates the proper speeds and feeds for various sized drills for high speed drilling in iron or steel. Each machine is equipped with an improved tapping attachment controlled by a lever near the spindle head which instantly starts, stops or reverses the spindle. There are five geared feeds ranging geometrically from .004 to .028 in. per revolution of the spindle.

An automatic trip and depth gage may be set to the graduated scale to stop the feed at any desired depth. This is accomplished without dropping or disengaging the feed worm, which permits continuation of the handwheel feed after the power feed has been tripped. The handwheel feed may also be fed ahead of the power feed without disengaging the latter, which is particularly advantageous in starting large drills.

The spindle quick return is of the expanding ring friction type and operates also without disengaging the feed worm. It serves as a hand lever for sensitive drilling, for tapping, for rapid raising or lowering of the spindle and for engaging and disengaging the power and hand feeds.

The machine may be driven by a constant speed motor geared or belted to the speed box, or by a 3 to 1 variable speed motor which eliminates the speed box. All styles of drives are interchangeable. The machine drills to the center of a 21 in. circle; has a distance of 49½ in. from the base to the spindle, and a base working surface of 19 in. by 20 in. The table diameter is 17 in. and the distance from the table to the No. 4 Morse tapered spindle, which has a traverse



Fosdick 21-In. Heavy Duty Drill

of 11 in., is 33 in. The sliding head traverse is 22 in., the column diameter, 7 in. and the net weight 2,100 lb. These machines are also furnished as gang drills having from two to six spindles, and various types of tables, bases and drives.

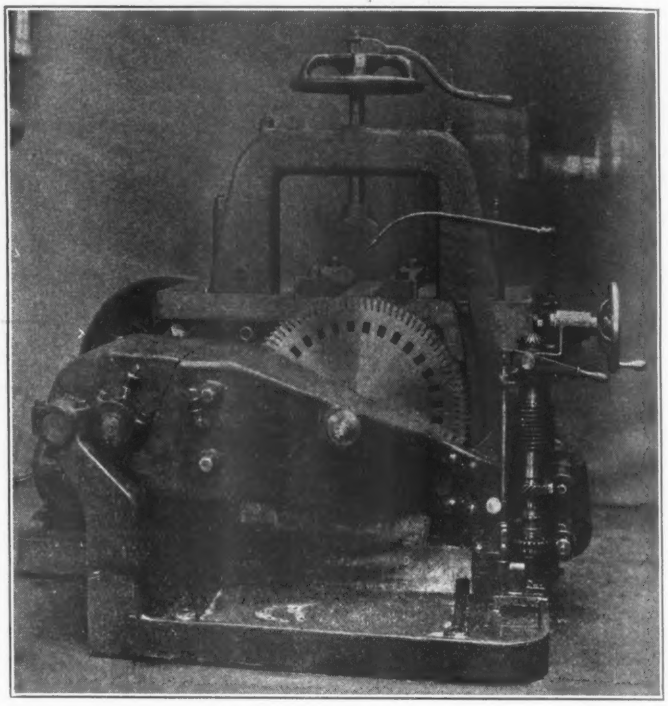
Cold Metal Saw for Heavy Duty

MANY valuable features are included in the No. 26 Lea-Simplex cold metal saw, illustrated. This machine has been developed by the Earle Gear & Machine Company, Philadelphia, Pa., for cutting high grade alloy steel, gear steel, etc. Particular attention has been given in the design to secure a machine able to stand up under the heaviest cutting feeds and speeds of which inserted tooth high speed saw blades are capable.

Arrangements are made for quick preparation of the cut, rapid location of the blades, maximum cutting speed, fast feed and automatic stops, with power return of the blade upon completion of the cut. The clamping fixtures are convenient, the clamp screw being tightened by means of a detachable clamping lever. T-slots in the table permit holding the stock at any desired angle. The machine cuts large stock, using exceptionally small blades with resultant economy in power and material. Combined hand and power advance is provided; also power return. A tripping device will stop the advance at any pre-determined depth of cut. The saws are built with quick change gear feeds, the feed varying from ½ in. to 1½ in. The rate of feed can be changed while the saw is cutting.

The saw blade is supported at only three points, being guided and pulled through the work (not pushed) with a steady motion free from jerks and jolts, resulting in a smooth cut surface. The blade is fed upward into the stock and, therefore, does not touch the work at an angle even if an angle cut is to be made. There is no tendency to crowd the blade away or distort it; hence angle cuts can be made with great accuracy. Centralized control is provided and all operating levers can be reached from one point. One attendant can operate several machines by using the automatic stop and high priced operators are not required.

Simplicity, rigidity, durability, compactness and flexibility are features claimed for the No. 26 Lea-Simplex saw which is said to be equally efficient when cutting solids, structural material, soft steel, tool steel, cold rolled shafting, copper billets, brass ingots, rails, etc. Round stock up to 11 in. in diameter, square stock up to 10 in. square, flat and structural shapes equivalent to 20 in. I-beams can be cut. The work table is 22 in. by 44 in. by 35 in. high. The space



No. 26 Lea-Simplex Cold Metal Saw

under the clamp yoke is 14½ in. high by 18½ in. wide. The machine weighs about 4,500 lb. and requires a floor space 60 in. by 72 in. A 24-in. driving pulley with a face 6 in. wide, running at 115 r.p.m. is required.

Roller Bearing Featured by Staggered Rolls

STAGGERED roller bearings, manufactured by the Hart Roller Bearing Company, Orange, N. J., represent a distinct departure from the conventional roller bearing design in that they employ a series of short rolls, staggered about the periphery of the raceway, as an anti-

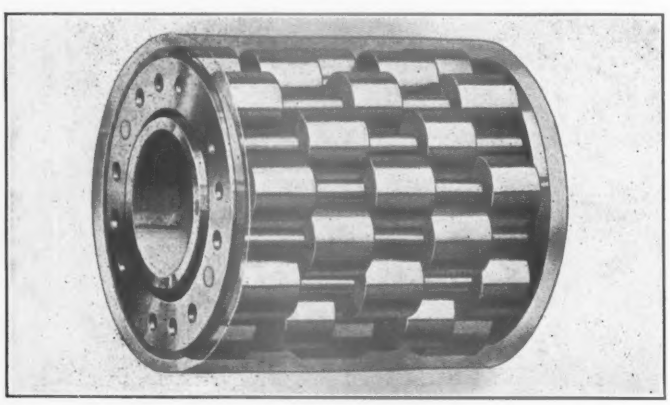


Fig. 1—Hart Staggered Roller Bearing

frictional method of efficiently carrying large radial loads. These rolls are made of high carbon, high chrome steel, hardened and ground, and operate between two raceways of the same material. The rolls are mounted axially on steel cage pins, with a suitable running clearance, determined by design proportions, and practical experience. The cage pins are riveted to steel end rings and the rings, pins and rolls constitute the roller assembly which operates between the

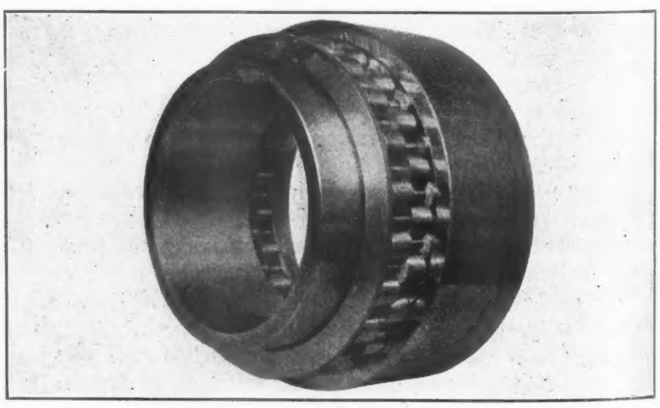


Fig. 2—View Showing Inner Race, Staggered Rolls and Outer Race

raceways. This form of bearing construction is said to provide freedom from roll breakage, maximum load carrying capacity, excellent lubrication and long life.

In roller bearings having a series of long, continuous rollers it is difficult to grind true cylinders without taper. Also, there is danger of roller warpage during heat treatment.

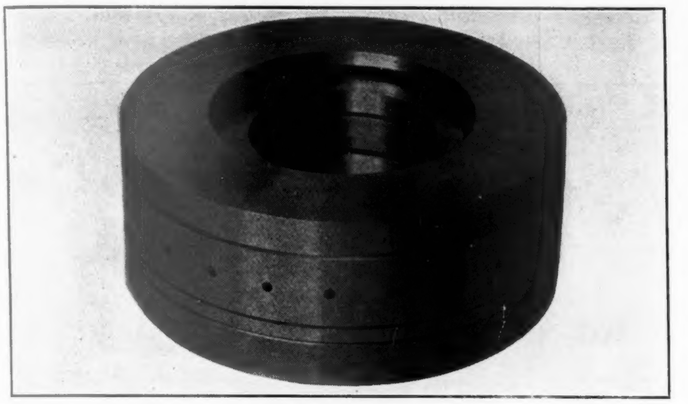


Fig. 3—View of Assembled Thrust Bearing

Other things being equal, the roller warpage varies practically as the ratio of the length to the diameter of the rollers and it is obvious that in short rolls, with the diameter approximately equal to the length, warpage is reduced to a minimum. Long rollers, due to warpage, possess an inherent misalinement and, when a load is applied to the bearing, frequently tend to skew diagonally with the races. This tendency is accelerated by the running clearance provided for successful operation and the result, frequently, is roller breakage. By employing a series of short rolls the skewing tendency is so small that the rolls adjust themselves to such variations.

An additional advantage of staggered rolls is their more equal distribution of the load. They present a multiplicity of raceway supports and adjust themselves absolutely to that portion of the raceway which they carry. The result is a maximum utilization of roll length for load purposes, incident to full line contact on each roll in the load zone. This staggered construction permits of maximum load carrying capacity per unit length of roll.

Spaces or pockets between the staggered rolls serve as oil reservoirs which feed lubricant zig-zag to the periphery of the rolls, to the space between the rolls and cage pins, and to the faces of the cage rings. All contact surfaces are thoroughly and automatically lubricated, the rolls themselves giving the lubricant mass such a motion that it distributes itself adequately to all vital points.

Drilling Machine With Nut Facing Fixture

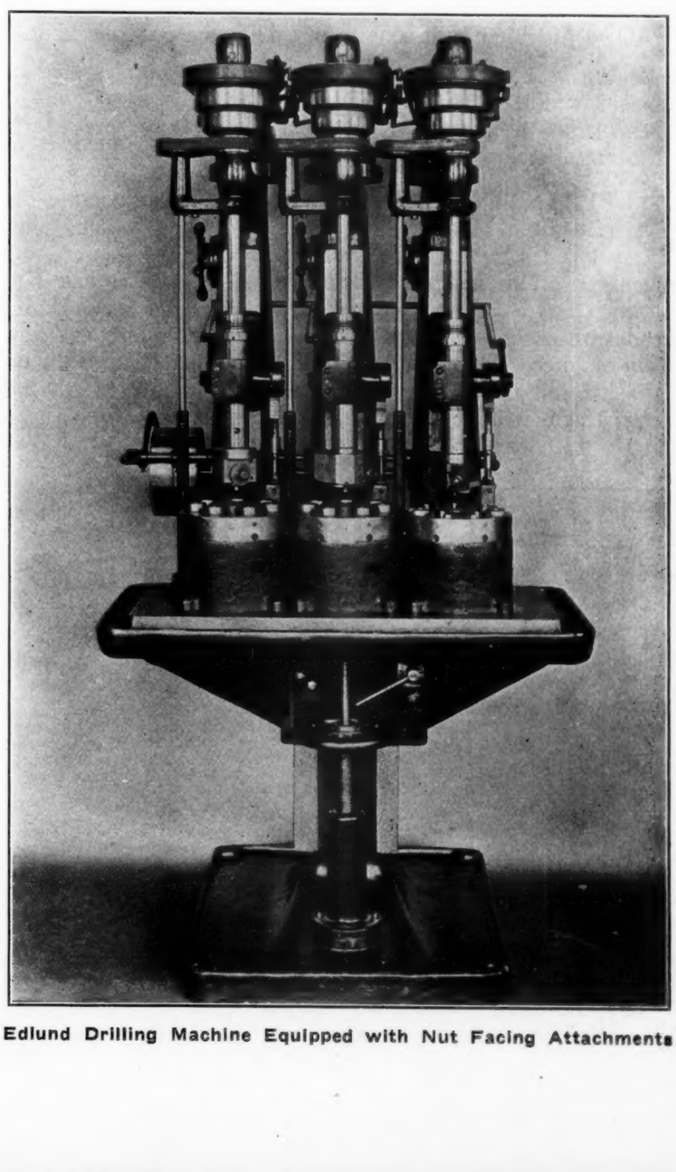
THE drilling machine fixtures, illustrated, are used for facing the top surface and the bevel of hexagon, cast-brass and valve packing nuts, and will accommodate nuts from 1 in. to 2¼ in. across the flats. The fixtures operate automatically, and are attached to a three spindle drilling machine, manufactured by the Edlund Machinery Company, Cortland, N. Y.

The machine is furnished with a standard drive, using four-step cone pulleys. The available spindle speeds are 510, 816, 1,273 and 2,038 r.p.m., with the drive pulley running at 500 r.p.m. The highest of the spindle speeds (2,038 r.p.m.) is too fast for the requirements of the job for which these fixtures are intended. Consequently the high speed step of the front cone pulley is utilized to furnish the power by means of which the automatic fixtures are operated. Extra large spindles are fitted to the machine, which are equipped with plain hardened steel and bronze thrust bearings at the lower end, for the purpose of taking the cutting thrust, ball thrust bearings at the upper end being provided to support the weight of the spindle when running idle. It is necessary to remove about 1/16 in. of material in the facing operation and the resulting finish must be smooth and free from chatter marks.

The automatic fixtures consist of a revolving work-table, indexed by a cam carried by a camshaft located at the rear of each fixture. This camshaft, which cannot be seen in the illustration, is driven by worm-gearing, the worm being attached to the vertical shaft which takes its power from the lower step of the front cone pulley. The cam, by means of which the spindle is fed, is designed to approach the cut quickly and then feed to the desired depth, allowing the tool to revolve several times after the facing operation is complete so as to give a smooth finish. The spindles are fed down against the tension of long helical springs and after the feed is completed the spindles are returned by the pull exerted by these springs. A safety device has been incorporated in each fixture which makes it impossible for the table to be indexed until the spindle is at the end of its stroke.

The operator's only duty is to load and unload the fixtures which can be done while indexing or during the cut.

The production time for 1-in. nuts is 1,000 per hour when all fixtures are in operation on the same size. The spindle speed is 1,273 r.p.m. in this case, and the feed 0.006 in. per spindle revolution. For large nuts 2¼ in. across flats, the possible output is said to be 420 faced nuts per hour.



Edlund Drilling Machine Equipped with Nut Facing Attachments

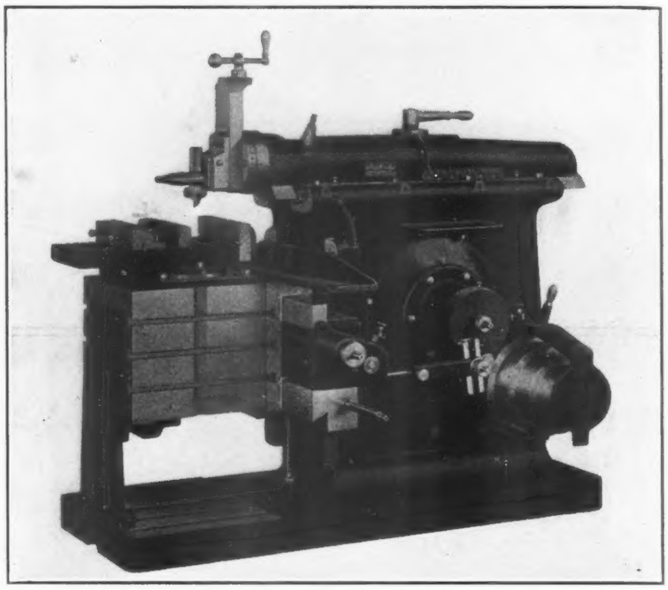
Cone or Single Pulley Driven Shaper

A LINE of shapers, built in five sizes with strokes of 12 in., 16 in., 20 in., 24 in., and 32 in., respectively and arranged for cone pulley or single pulley with gear box drive, has been placed on the market by the Bertschy Engineering Company, Cedar Rapids, Iowa. The column of the machine is designed for strength and rigidity, being maintained in alinement with the base by means of a tongue and groove. Referring to the illustration, it is evident that the base extends beyond the sides of the table and around the column thus affording a substantial foundation.

The hub bearing of the semi-steel bull gear is supported by a flanged bushing firmly secured to the column. The rocker arm is mounted on a counter-weight held in the column and extending into the base. Forty-five deg. V-ways are provided for the ram, only one adjusting gib being necessary. The ram can be positioned while running by means of the adjusting screw illustrated. The weight of the swivel head is carried by a large plug bearing in the ram head, the tool box being similarly mounted. Micrometer adjustments can be made by means of the dials on all cross and down feed screws.

The cross rail is held by tension bolts when the locking bolts are loosened. The elevating screw is operated by means of a train of bevel gears, mounted on ball thrust bearings. The table is of substantial construction as shown in the illustration and is provided with T-slots cut from the solid metal. A tongue and groove arrangement holds the table in alinement and braces at the outer end are arranged to support it when taking heavy cuts. A friction safety device on the power crossfeed prevents damage due to feeding beyond the limits of the machine.

When provided with cone pulley drive, no outer bearing is needed since the pulley runs on a large sleeve mounted on the column. With single pulley drive, a gear box having a train of heat treated alloy, steel cut gears is provided. Four

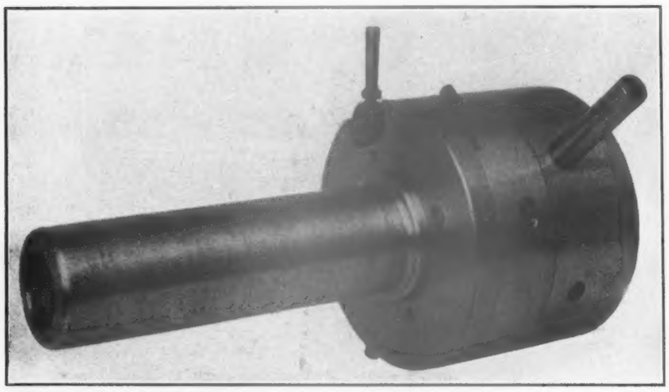


Bertschy Cone-Driven Shaping Machine

changes of speeds, with two ratios in the bull gear train, make a total of eight available speeds. When desired the machine can be arranged for motor drive through a silent chain.

Self-Opening and Adjustable Die Heads

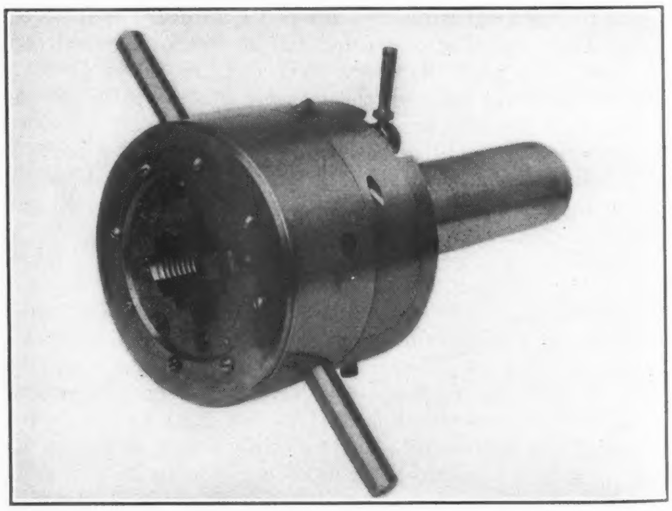
SUPPLANTING its Style B self-opening, adjustable die heads, the Modern Tool Company, Erie, Pa., has developed a Style H die head for hand or automatic screw machines. This head is made up to and including size No. 5 which has a capacity of 1 in. to 2 in. The Style H die heads are designed to cut any thread right or left and any form of pitch. Each head will cut every diameter within its capacity and the threading may be done to any length the turret travel will permit. Straight or taper threads may be cut the full length or close to the shoulder. A special fea-



Modern Style H Self-Opening Die Head

ture of the Style H head is a "float" which compensates for the drag of the turret.

The die head chasers are supported at the outer edge by a cam ring, making it practically impossible for chasers to change position during the work. This is an important advantage resulting in accurate work and smooth threads. The chasers are hobbed and held in chaser blocks with



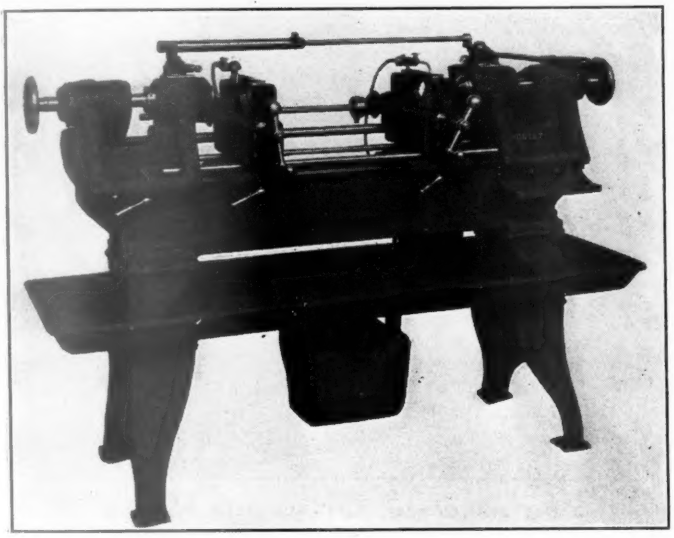
Another View of the Style H Die Head

screws. These chaser blocks fit in T-slots in the die heads and are rigidly supported at the outer end by a cam ring which holds the cutting points of the chaser in the proper relative position. Coil springs hold the chaser blocks against the cam ring in conjunction with screws through the ring. By removing these screws the chaser blocks may be taken out for cleaning without disturbing any other parts.

Micrometer adjustment is provided on the head for changing the position of chasers in case threads are too tight or too loose. The die heads are mounted on shanks which are made hollow for threading long pieces. The dies open automatically when the turret travel ends or may be opened at any point by stopping the feed. An internal trip may be installed when ordered. Dies may be closed by handles on the side or by a closing pin set for contact with the turret slide as the turret turns to the operator's position. The new style H head also has a roughing and finishing attachment incorporated. Special ring closing, taper threading and yoke closing attachments are available if desired. A special base plate also is made when it is desired to attach the die head to hollow hexagon machines.

Double Spindle Centering Machine

Made by the Hendey Machine Company, Torrington, Conn., the double spindle centering machine, illustrated, was designed to meet the requirements for accurate centering and ease and quickness of handling. The headstock casting is large, being so made to accommodate ball bearings for the spindle. The rear housing is fitted with two radial thrust type ball bearings which carry the sleeve of chain drive sprocket. The spindle is free to slide in the sprocket sleeve and is driven by a key in the spline. The front housing carries a sleeve with a taper bearing which furnishes a satisfactory method of taking up wear on the spindle.



Hendey Double Spindle Centering Machine

A locking pin for the spindle is applied to the head casting but is always held in "out" position by means of a spring so that when it is desired to loosen the chuck by means of the draw-in hand wheel, the pin must be manually held in engagement with the spindle. As the pin is released when the operator is finished there is no danger of its remaining locked with spindle due to oversight. The accuracy of alinement of the jaws is such that finished work can be centered to within .001 in. with an eccentricity which will not exceed .002 in.

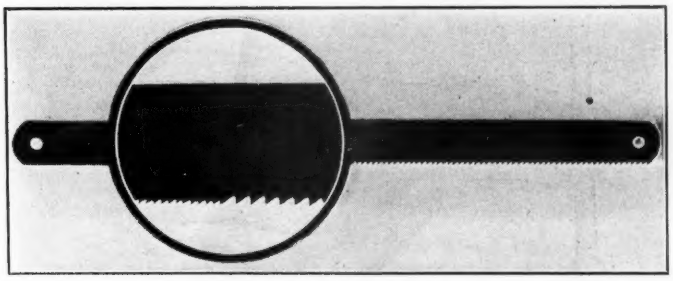
The saddles of the vise blocks are well proportioned, having a bearing length on bed of 7 in. Binding handles give quick release and lock when a change of position is necessary. Simultaneous movement of vise and support is maintained by means of a connecting rod and beveled gear drive controlled from the one ball handle at the front of the vise.

The power shaft is supported in sliding pillow blocks, so arranged as to secure necessary tension on a chain drive. Both chain drive and driving pulley are completely guarded. The machines may be readily adapted to motor drive, and for this purpose a pad to receive the motor bracket is cast on the rear side. Motors of approximately 1/6 hp. and with a speed of 1,200 to 1,500 r.p.m. are recommended as a satisfactory power unit for the single head machine, while a ½ hp. motor will be ample for the double spindle machine.

Hack Saw Blade With Fine and Coarse Teeth

The Peerless Machine Company, Racine, Wis., has developed a duplex hack saw blade with fine 32-point teeth at the toe and coarser 16-point teeth on the rest of the blade. The advantages of this design in starting a cut are obvious since the fine teeth at the toe cut easily and true at slow starting speed, preparing the way for faster cutting as the coarse teeth on the rest of the blade enter the work. Cuts can be started on sharp corners without adhering to the bad practice of drawing the blade backward over the work. With duplex blades, the fine teeth at the toe take hold of sharp corners without chattering or jumping sideways, producing an accurate cut and eliminating shelled teeth and broken blades.

Peerless duplex blades are made in two types; all hard tungsten steel and flexible carbon steel. The former, correctly hardened and tempered, are especially adapted for use by toolmakers in cutting tough steels and by mechanics for general use. The cutting edges are hard and tough, and stand up well on difficult sawing jobs. The carbon steel flexible type is hardened on the tooth edge only, the remainder of the blade, being toughened to prevent excess stretch when tensioned. It is able to withstand severe usage without breaking. In electrical and steam-fitting work, or in other trades where the material to be cut is of a thin, irregular section, and where the work cannot be held rigidly in a vise or reached from an easy sawing position, the duplex hack saw blades offer valuable assistance. They are made in 8- 10- and 12-in. lengths, being ½ in. wide and .025 in. thick.



Peerless Duplex Hack Saw Blade

Semi-Automatic Twist Drill Grinder

THE drill grinder illustrated is automatic in the actual sharpening of drills, but semi-automatic in the general movement of the mechanism. It will sharpen a 2, 3 and 4 lip right or left hand drill theoretically correct and in an extremely short time. In operation the holder arm is held in a horizontal position by means of a counterbalance. The drill, if a taper shank, is placed in the holder or spindle direct and, if a straight shank drill, is held in a suitable chuck. The holder with drill is then brought forward to meet the drill point gage, which indicates the proper distance to the grinding wheel face as well as the right height of the drill lip, in order to obtain the correct angle of the extreme point. The arm is swiveled to the angular stop and while held against this stop, the arm is being moved down and up several times, the finishing cut being downward only. After one lip is thus ground the drill spindle is then indexed to the next lip and the operation repeated as previously explained.

The rotation and oscillation of the drill is controlled by the upward and downward movement of the arm. This movement, a semi-automatic action, gives the drill a convex backing of the lip and consequently a long cutting life as well as smooth production. A cross feed movement is also provided so as to make possible the use of the full face of the grinding wheel. This is also used for truing the grinding wheel.

The machine is being built in two sizes, one size to grind drills from 1/16 in. to 1½ in. diameter, and the other to grind drills from ½ in. to 3 in. in diameter. Drive is by means of a suitable motor with a two step pulley so as to obtain the necessary peripheral speed of the grinding wheels. On special request the machine can be easily arranged for countershaft drive.

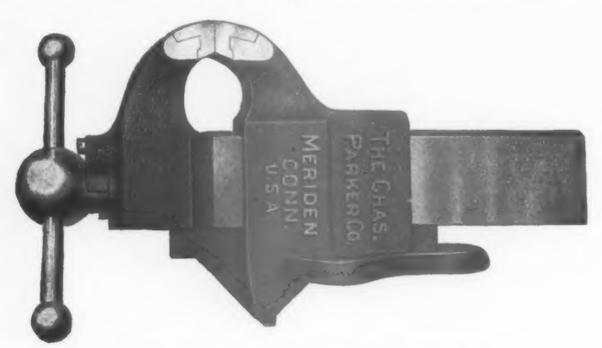
The great importance of a properly sharpened drill has long been realized and the drill manufacturers have always stood ready to afford the user of drills all possible information concerning the proper clearance and angle of the drill and correct methods of sharpening. As a matter of fact, a drill not properly sharpened will not only ruin the drill itself, but will cause all kinds of unnecessary expense such as breakage

Twist Drill Grinder, Semi-Automatic in Action

of machinery, wear of jigs and loss due to spoiled machine parts which must be sent to the scrap heap.

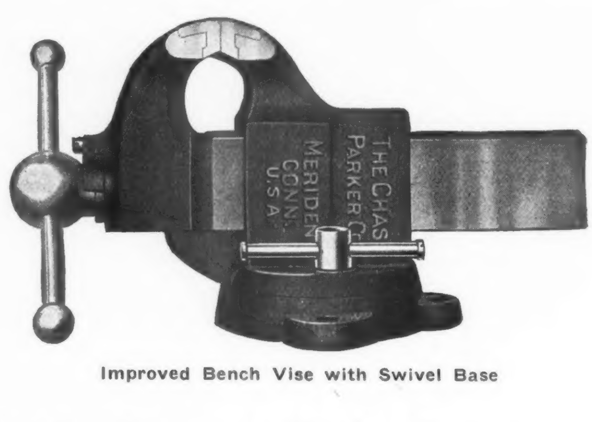
Convenient and Durable Bench Vises

IN the latest design of bench vises manufactured by the Charles Parker Company, Meriden, Conn., every effort has been made to produce a strongly made vise and one which will be convenient to use on account of the ability to swivel it at any required angle independent of previously determined, angular stop positions. The new vise in the



Parker Vise Furnished with Stationary Base

4-in. size has been made approximately 30 lb. heavier than earlier styles and solid (not cored) semi-steel castings are used to insure maximum rigidity and strength. A swivel clamping device which holds to the entire circumference of the side wall is provided. This arrangement is so designed that when the clamping screw is tightened, pressure



Improved Bench Vise with Swivel Base

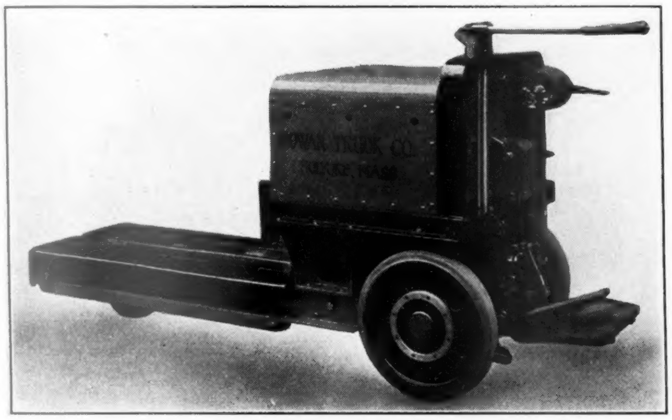
is brought to bear on a V-shaped wedge which expands a ring against the base and holds the vise firmly. The under portion of the slide is made solid, as shown in the illustrations and strengthened by means of an inserted steel bar. The two steel jaw faces are separate, removable and

renewable which is an important advantage. They are not welded or fastened to the jaw faces by screws which often work loose but are milled and fitted accurately, being held in place by pins. The vise is made in seven sizes with jaw openings from 3¼ in. to 7 in. as illustrated, and can be provided with a stationary base if that type of vise is desired.

Improved Electric Self-Loading Truck

SEVERAL distinctive features have been included in the recently improved truck, illustrated, which is made by the Cowan Truck Company, Holyoke, Mass. Simplicity of design is combined with a minimum of parts all sturdily constructed. The guaranteed capacity of the truck is 5,000 lb.

The lifting mechanism is of the heavy bell crank type, a new application to electric truck lifting mechanism construction. It is actuated by an independent, heavy duty, series wound motor with a worm gear reduction, the platform elevating vertically with a maximum rise of 4½ in.



Cowan Electric Self-Loading Truck

The truck, equipped with a full capacity battery, elevates a 5,000 lb. load in five seconds, and elevates without load in three seconds. The full lowering time is three seconds. The platform may be stopped at any point going up or down and the direction of motion reversed.

An "anti-kick" device takes all jar from the steering handle when the truck travels over rough spots. The power axle consists of only three parts, a shaft, splined ball and clutch. The rear end is equipped with a heavy bumper which effectually takes all shocks and protects the rear end of the lift platform. It is also equipped with a draw bar attachment, permitting the truck to be used as a light duty tractor. The draw bar attachment is integral with the frame and, with a load on platform, there is no strain on the elevating mechanism.

Other important features include an automatic brake and circuit breaker application, four wheel steer, single reduction worm drive of the power axle and easy accessibility of batteries, lifting and driving motors and control mechanism. The batteries are assembled in one tray for quick removal and are supported by springs which relieve them from road shocks and vibrations under all conditions of load. The controller is of the drum type with three speeds forward and three reverse.

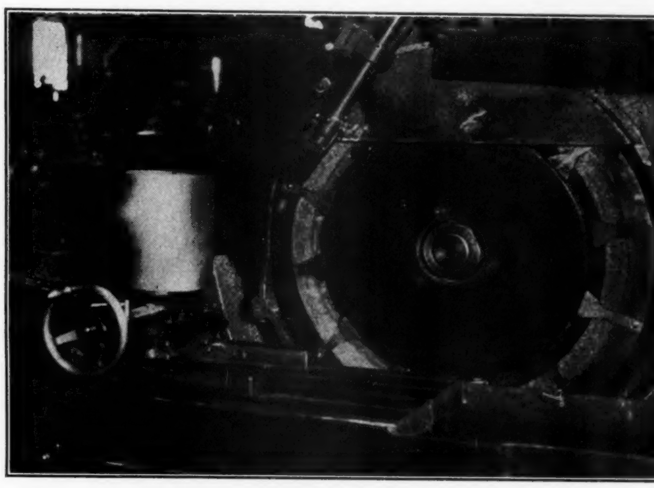
The turning radius (extreme outside point) is 7 ft. 10 in. By folding the foot pedal and steering handle into a vertical position, the overall length is shortened for use on elevators. The length is 102 in. overall, or 91½ in. with the step raised. The width is 36 in. overall and 51 in. high over the steering shaft head. The truck will operate in intersecting aisles 58 in. wide. Further advantages of this truck are its all-steel construction, low center of gravity and ruggedness, features which are of particular value for the more or less severe usage accorded trucks in railroad service.

Sectional Wheel Chuck for Face Grinder

INSTEAD of a solid ring of abrasive material the Diamond Machine Company, Providence, R. I., has developed for use on the Diamond heavy duty face grinder a sectional wheel made up of twelve segments. Each segment is held in place by two wedges. Each alternate wedge is fastened; the other is movable. The grade and grain of abrasive used in the blocks or segments is the same as that used in the solid abrasive ring. The blocks are tightened in place by means of six square head set screws countersunk in the periphery of the chuck. The same means for setting out the blocks is employed as in the case of the solid wheel; namely, a cast steel backing plate is drawn forward by six set screws. The blocks can be furnished either 2 or 3 in. wide whichever may be desired.

The life of the segments has been found to be approximately the same as that of the ring wheels. No undue spawling or breaking down of the corners is observed. Furthermore, in the case of work having wide area, the use of the sectional wheel tends to diminish the area of contact. It is maintained that the openings between the segments permit freer cutting and cooler grinding, thus diminishing heating or warping of the work if the feed is crowded. The basis of this claim seems to be that the openings between the blocks permit of easy access of lubricant between wheel and work.

Comparison between the prices of segment and ring wheels shows that the cost of segment blocks is less than one-half the cost of solid ring wheels. Sectional chucks are now standard equipment for new machines and can be furnished for machines in service if the latter are not so equipped.



Diamond Sectional Grinding Wheel Chuck

Three-Quarter Inch Double Spindle Threader

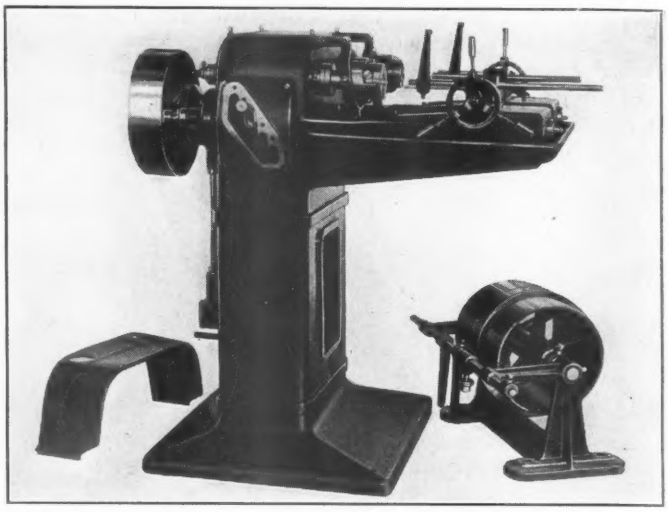
THE machine, illustrated, is designed primarily for threading work in which the threading time for both pieces is sufficient to allow the operator to chuck and start a second piece while the first is being completed. For this class of work the double spindle threader is a rapid producer, handling practically as much work as two single spindle machines with two operators. For tapping sizes smaller than is practicable with a collapsing tap, the use of the machine fitted with a ball drive reversing tap holder is recommended. The two spindles, mounted in large bronze bearings, are driven by a single pulley, located at the rear of the machine, but can be driven independently by means of the change gear levers at either side of the machine. Each carriage is fitted with a two-jaw chuck, operated by a hand wheel. An adjustable stop on the trip rod ahead of the carriage governs the opening of the die head and the length of the thread to be cut. The adjustable stop back of the carriage controls the closing of the die head.

A single geared pump, driven from the main shaft by means of bevel gears and a flexible shaft, forces oil from the reservoir through the spindles and die heads against the work. When equipped with a collapsing tap or reversing tap holder, the oil is fed through pipes on the outside of the machine. The lubricating system may be easily removed for cleaning and inspection.

Change gear levers on the sides of the machine control the spindle speed independently and may be set to furnish the proper speeds for the threads being cut.

A safe cutting speed for any diameter is one which will insure the maximum production without causing excessive wear on the chasers. If the speed for which the machine is designed is too fast to permit of this it should be run more slowly, regardless of the index. Accuracy depends to a very large extent on the cleanliness of the die head. The die head should be inspected periodically, all dirt, chips and gummed lubricant being removed. The use of a suitable lubricant makes a better thread, prevents wear and overheating and keeps the die head cleaner.

The ¾ in. double spindle threading machine is regularly equipped with ¾ in. geometric die heads, giving a cutting range of ¼ in., ⅜ in., ½ in., ⅝ in. and ¾ in. diameter



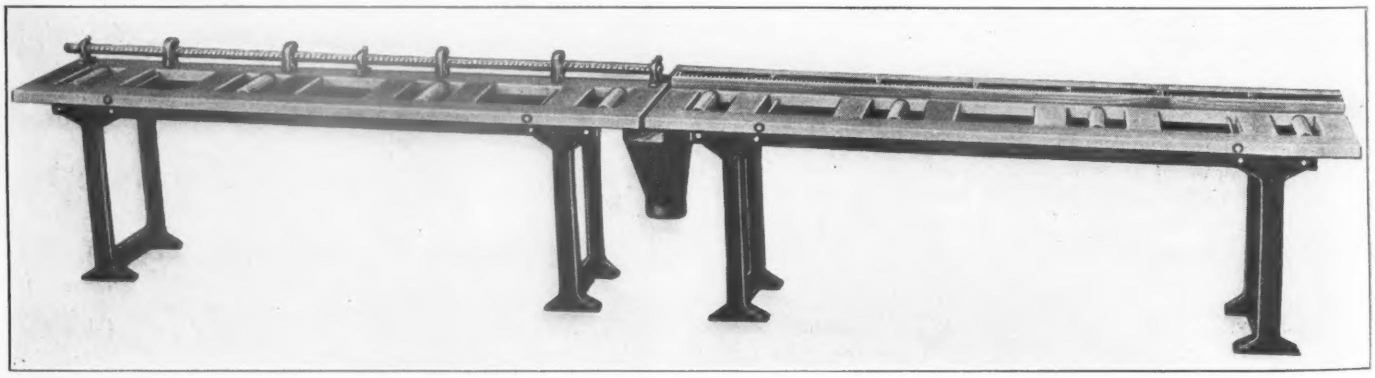
Geometric ¾-In., Double Spindle Threading Machine

and ⅛ in. to ½ in. standard pipe. The greatest length that can be cut at one setting of the work is 8½ in. With resettings a length of 14 in. may be cut.

When the countershaft speed is 373 r.p.m. the spindle speeds for cutting ¼ in., ⅜ in., ½ in., ⅝ in., ¾ in. are 225; 150; 113; 90 and 75 r.p.m., respectively. When the machine is fitted for motor drive, a 3-hp. motor is required.

Overhead Swing Cut-Off Saw Table

A SAW TABLE designed to be used with an overhead swing saw has been placed on the market recently by the Oliver Machinery Company, Grand Rapids, Mich. This table is 16 ft. long, 19½ in. wide and 30 in. high, being made of kiln dried, rock maple with angle iron girths and one piece cast iron legs. The table is composed



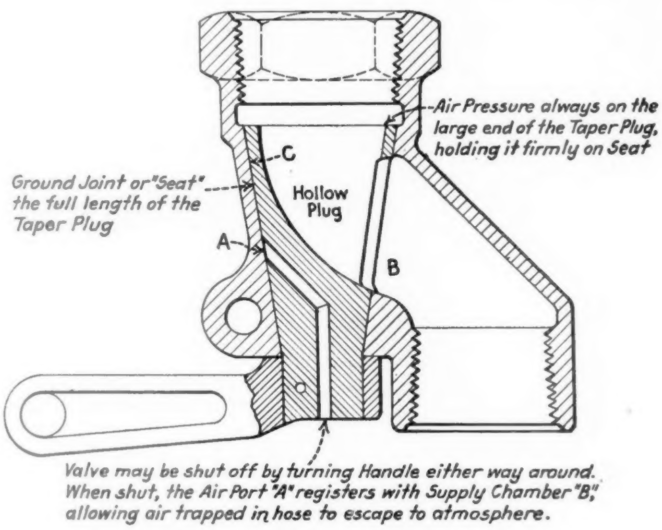
Special Oliver Table Designed for Use with an Overhead Swing Cut-Off Saw

of two parts of sections. On the rear of the right hand section is mounted the scale rail, graduated in ⅛ in. from zero to 96 in. These graduations are plainly marked and accurate. On the left hand section is mounted a patent automatic swing cut-off saw gage in the form of a square rod, also graduated in ⅛ in. from zero to 96 in. Four automatic malleable iron stops are provided; also one center and two end rod holders.

Where a large number of parts have to be cut off to the same length this automatic saw gage is an important time saver. Rollers are inserted in both sections of the table in every other opening for the full length. A dust chute is fastened between the two sections of the table, having a 6-in. diameter pipe opening connecting to the exhaust system.

Pressure Seated Valve Reduces Air Losses

THE Cleveland Pneumatic Tool Company, Cleveland, Ohio, has recently brought out an air valve for general use which contains new features of interest. The sectional drawing shows the new valve designed to eliminate air losses through leakage in transmission.



New Design of Pressure Seated Air Valve

The destructive action of compressed air upon valve seats, packing and gaskets is well known and this valve was designed so that air cannot come in contact with the seat, thus avoiding replacement of the seats. The design also utilizes air pressure as a seating agent to hold the valve plug on its seat, thus eliminating packing, gaskets, stems and springs and reducing the valve parts to a body, plug and handle.

A hollow taper plug in the supply chamber connects directly with the air hose without the air coming in contact at any time with the ground valve seat, which is the outer wall of the plug as indicated by the letter *C* on the drawing. The air travels through the wide unobstructed air passage of the valve which is free from any angle turns to impede its progress. A short arrow indicates the point on the large end of the plug where the air pressure is constantly forcing the taper plug against the walls of the valve body and forming a perfect seat.

The valve is provided with a unique waste arrangement to allow the accumulated pressure in the air hose to escape to atmosphere when the valve is shut off as shown by air ports *A* and *B* on the drawing. This arrangement safeguards the operator, who, when disconnecting the hose from the valve, often receives a gush of air in the face and accidentally gets scale or dirt in his eyes with more or less serious results.

The new valve has been subjected to severe service tests under both high and low air pressures (the high pressure being 500 lb.). Submerged water tests and exacting tests on acetylene gas lines have also been successfully passed.

Lathe Lead Screw Variator Device

FOR elongating or diminishing the normal lead of lathe lead screws, the Precision & Thread Grinder Mfg. Co., Philadelphia, Pa., has developed the device illustrated. This device facilitates the use of an ordinary lathe for precision lead work, correcting any errors in the lead. The variator is built in two models of similar design but different size. The model "A" is adjustable to fit lathes up to 12 in. swing, model "B" being adjustable to fit lathes with 13 in. to 20 in. swing.

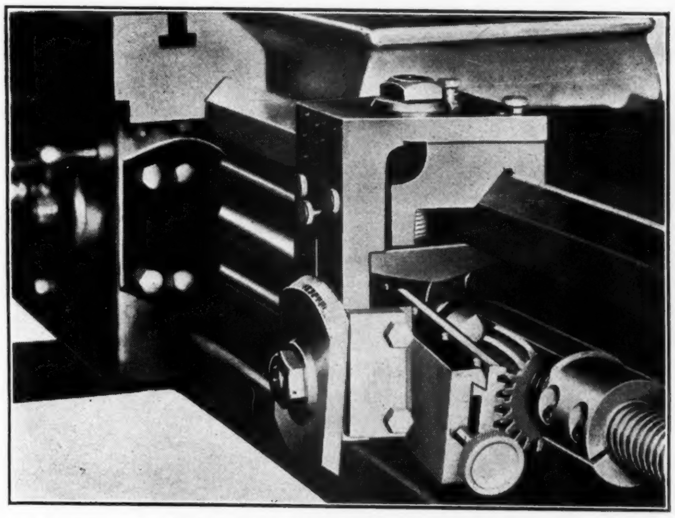
The device consists of a bracket, clamped upon the ways of the lathe and composed of two pieces, the outer frame, and the ways adaptor. The outer frame is adjustable horizontally, sufficient to make the proper connection between the bracket and the mechanism which is carried on the lead screw.

The bracket carries a swivel rack and provision is made for vertical adjustment to bring the rack swivel center in line with the center of the lead screw. This adjustment can be locked, and subsequent tilting of the rack does not disturb the vertical adjustment previously made. The rack is provided with a graduated scale to show the angular setting of the rack.

The lead screw mechanism consists of an adjustable nut with an extension carrying a gear segment free to swivel in line with the rack. The variation in the lead is obtained by this gear segment revolving in accordance with the swivel of the rack as the nut is traversed in either direction by the action of the lead screw. In using this variator, the regular lead screw nut in the lathe carriage is not employed, but connection is made between the variator nut and the lathe carriage by two rods and a plate. A longitudinal traverse of 6 in. is available.

Wear of the variator nut is reduced to a minimum because the nut moves the lathe carriage only during machining or grinding operations. The return of the carriage to the initial position is obtained by a sliding nut, keyed in the variator nut frame and permitting independent longitudinal movements in excess of the possible variation of lead. This is an important feature.

A dust guard is furnished to protect the lead screw from abrasive dust in grinding operations. It is recommended that the device be positioned near the threaded end of the lathe screw as that portion of the lead screw is generally unused, and more nearly correct than other sections.


Lead Screw Variator Applied to Lathe

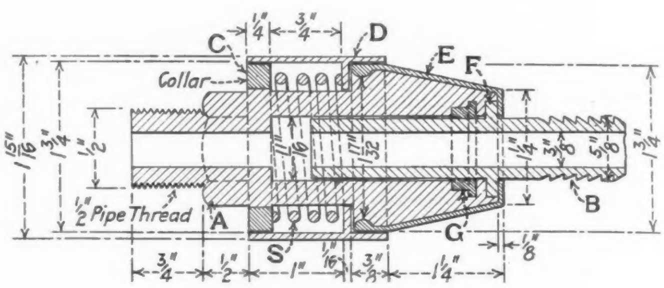
Air Hose Coupling of Simple Design

SIMPLICITY and rugged construction are features of a new air hose coupling invented by John Ph. Weber, 881 Park street, San Bernardino, Cal. Several of these couplings have been used for some time in the shops of the Atchison, Topeka & Santa Fe and have proved satisfactory in withstanding the severe usage accorded air hose couplings in railroad shops.

A particular advantage of the coupling is the fact that two hose parts can be connected together without twisting or turning of any kind. All that is required is to enter one part of the coupling into the other and push the two parts firmly together. They are then released by pulling back a knurled sleeve. On account of the gasket being inside, it is protected from injury and fits tight around the outside of the male part, forming an air tight joint.

Referring to the illustration, details of construction will be evident. Part *A* is made of cast iron, turned and bored as indicated, with a thread on one end to make into the air line. Part *B* is roughed on one end in order to be held more securely in the hose when the outside clamp is tightened. Collar *C* is a drive fit on part *A* and holds a knurled sleeve *D* in the position shown by means of spring *S*. Snap spring *E* is arranged to fit on over shoulder *F* of part *B* and has four prongs of the cross section shown. *G* is an L-shaped gasket fitting in a corresponding groove in part *A* and making an air tight joint between the two coupling parts *A* and *B*.

In operation the part *B* is entered in part *A* and as these parts are forced together, spring steel snap *E* slides up on the taper end of *A*, pushing back sleeve *D* and entering the groove shown. Sleeve *D* springs back over the top of the spring snap *E* locking the same in the groove shown so that it is impossible for the coupling to blow apart or become disconnected without first pushing the sleeve back again. Another good feature of this coupling is the fact that air hose cannot become twisted by screwing on the air motor or hammer. The coupling acts as a swivel joint.



Air Hose Coupling for Shop Use

Portable Safety Vacuum Torch

MANY difficulties due to oil leaks and consequent danger of fire are prevented by the operation of portable torches on the vacuum principle. With this fact in mind the Norton Mfg. Co., Boston, Mass., has developed a portable safety vacuum torch, illustrated. This can be used for many pre-heating and steel straightening jobs in railroad shops and roundhouses. There is no pressure on the oil at any time, the torch being operated by a vacuum created by the passage of compressed air through the burner head. The result is that there can be no spurting or spraying of oil in case of breaks in the oil pipes or hose and the danger attendant on using oil under pressure is eliminated. On account of this fact and because it has withstood rigid tests, the Norton torch has been approved by the Associated Factory Mutual Fire Insurance Companies.

Portable Safety Vacuum Torch Adaptable to Use in Railroad Shops

In addition to the safety feature, the torch is said to be highly efficient, powerful and easy to manipulate. It lights instantly, requires no pre-heating and does not sputter. Either fuel oil or kerosene may be burned.

The tank is of heavy steel construction, being equipped with carrying candles and a rack welded on top for holding the torch when not in use. The torch is provided with two rubber tubes one conveying compressed air, and the other oil from the tank. The operating valve affords easy and accurate control of the flame. This portable safety vacuum torch was designed especially to withstand the severe requirements of railroad repair shops, boiler shops and foundries, and represents an important development for this purpose.

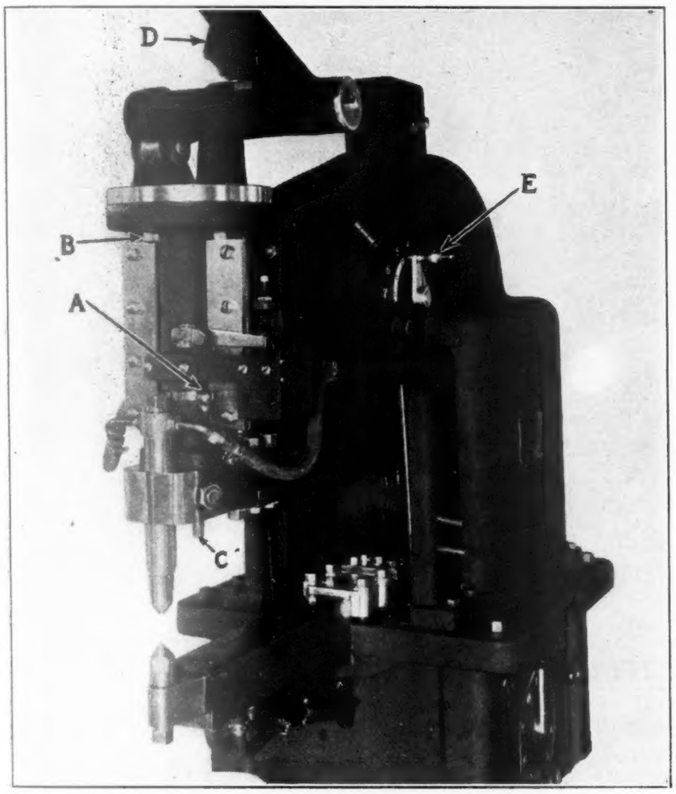
Dearborn Non-Volatile Liquid Cleaner

ONE of the disadvantages of liquid cleaners intended to dissolve oil, grease and dirt on machine parts has been the highly volatile, inflammable character of these cleaners and consequent danger of explosion of the gases given off. To overcome these dangers, the Dearborn Chemical Company, Chicago, has developed a compound known as Dearboline which not only has valuable solvent properties for removing foreign substances but does not give off highly explosive vapor and is said to be approved by the National Fire Underwriters Laboratories. Among the advantages claimed for Dearboline are solvent properties greater than gasoline, lower evaporation loss than kerosene, no danger of

injuring the hands of workmen, reduction of fire hazards to buildings and contents, long maintenance of solvent properties thus making it cheap to use; and the fact that it does not have to be mixed but comes ready for use. Dearbo-line is furnished in steel drums of 55 gal. capacity and in small gallon cans if desired.

Spot Welding Machine of New Design

FOR welding heavy stock a new spot welder has been developed by the Taylor Welder Company, Warren, Ohio. The head on this machine has square slides and steel caps instead of round spindles, as formerly, so that any looseness due to wear may be readily taken up and the alinement of the electrodes maintained. The hand lever will swivel 90 deg. from each side of the center, and can be locked in any position by screw *B*. When operating by foot, the hand lever remains in the upper position. The height of hand lever can be changed to suit the operator by a segment on the side of lever *D*. The travel of the hand lever and the foot treadle can be regulated to seven different positions by means of lever *E* on the overhanging arm. The foot treadle swivels to right or left and can be removed when not in use without making any disconnections. Pressure on the work may be changed by adjusting screw *C* in the center of the upper electrode holder. Changing from automatic to a non-automatic switch is accomplished by moving the small lever *A*. Water circulates through the upper and lower welding electrodes, prolonging the life of the electrodes.



Taylor Series 4 Water Cooled Spot Welder

The Series 4 machine, illustrated, has a capacity to weld two pieces of sheet steel 1/64 in. to ¼ in. or 28 to 3 gage. A 25 kw. transformer operating at 220 or 440 volts, 25 to 60 cycle, single phase is generally used. There is a 10-step, self-contained regulator for adjusting the current. Automatic and non-automatic auxiliary switches operate a magnetic controlled switch on the rear of the machine.

The distance between the lower horn and the copper bands on slide horn machines with the horn at the top of the slide is 6 in. and with the horn at the bottom of the slide, 26 in. The distance from the floor to the welding electrodes is 42 in., the greatest movement of the upper electrode being 3 in. One set of 1¼ in. water cooled electrodes, consisting of two straight, two offset and one flat electrode are standard equipment.

The operation of this type machine is by hand lever and foot treadle, either together or independently. When using the automatic switch, the electrodes are brought in contact with the work under spring pressure. Further movement of the hand lever or foot treadle turns on the current and the work heats immediately to a welding temperature. Further movement of the lever or treadle turns off the current and applies a positive pressure to the molten metal, completing the weld. The non-automatic switch is operated by a button in the end of the hand lever, the electrodes being brought into contact with the work under positive pressure. This permits the operator to apply a heavy pressure before and after the current is turned on and off, additional pressure also being applied with the foot treadle. The machines can be furnished in single or double currents.

A New Idea in Chain Making

ELECTRIC welded chain is now being made in all the smaller sizes from stock up to ½ in. and ¾ in. round. There are a number of different methods of forming and welding the links, but in all cases a flash of material at the point of welding is brought about by jamming the two ends of material together at the intense heat of the electric arc. Some manufacturers do not try to remove this flash because of the extra strength that it gives the weld, while other manufacturers have invented means of either grinding or shearing the flash away, making the link smooth at the welded point.

A new method of electric welding just developed retains all of the material at the flash, or welding point, but forces it to the inside of the link. The illustration indicates clearly the form of the link that is thus secured. It is claimed that by this method the welded portion is 25 per cent stronger than any other part of the link, and repeated breaking tests show that the material will pull out at other places than the weld when tested to destruction. This kind of chain is very smooth on the outside of the links and the swelled portion on the inside gives it additional strength. The method of manufacturing chain by this special pattern has been patented and the name "Inswell" copyrighted by the manufacturers, the Columbus McKinnon Chain Company, Columbus, Ohio.


Electric Welded Chain, Made of Stock Up to ¾-In. Round

Metal Booth for Timekeepers and Foremen

ONE of the new developments of the Lyon Metallic Manufacturing Company, Aurora, Ill., is a time booth for the use of timekeepers, department foremen and others. The time booth is made up of standard enclosure panels 84 in. high by 36 in. wide. The standard booth includes six standard plain panels, one sliding door panel and one service window panel. This makes up a booth which is six feet square. Booths may also be made up in larger sizes by using more panels, thus making them 6 ft. by 9 ft., or 9 ft. by 9 ft., etc.

The booth is regularly equipped with a steel table, 30 in. wide, 60 in. long and 31 in. high. The table is made from heavy furniture steel, reinforced on the under side by a pan. This table can also be equipped with drawers and a compartment, if desired. The plain panels are made up of two upright members, a heavy sheet of steel closing the base of the panel to a point 43⅝ in. above the floor, and from this point upward the uprights enclose a No. 10 wire with a 1½ in. diamond mesh. The upright members are 1½ in. by ¾ in. by ⅛ in. channels, inside of which sets the 1 in. by ½ in. by ⅛ in. channel frame which covers the wire mesh on four sides. The panels are secured to the floor by a 1½ in. by 1½ in. by 8 in. angle.

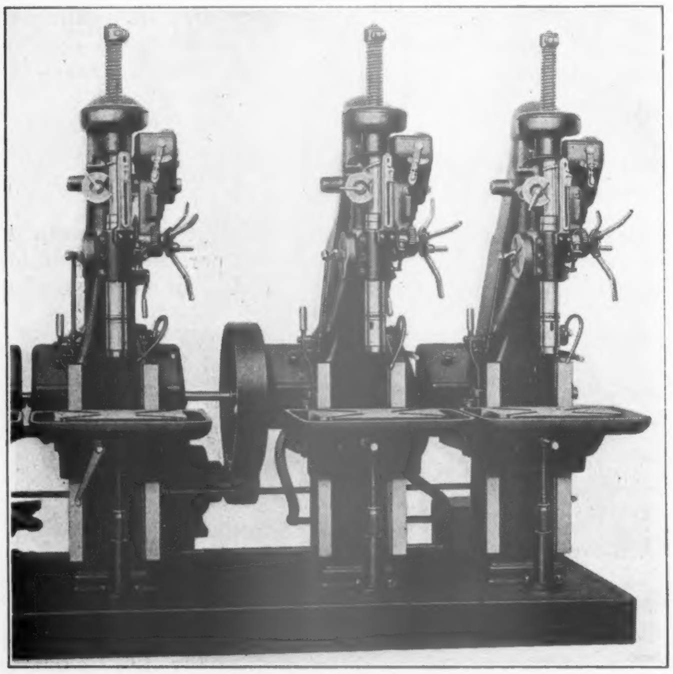
The sliding door panel has a door 78 in. high. The hanger is equipped with grooved wheels which run on a track of 1¼ in. by 1¼ in. by 3/16 in. tee, bolted diagonally to a filler strip, making the door self closing. It is equipped with an S & G door lock, with a hand hole and latch inside. The service window lifts up, sliding in a channel slide leaving an opening 17½ in. high and 24 in. wide. A heavy shelf running the entire width of the panel and extending out 18 in. is attached horizontal with the bottom of the window and 43⅝ in. from the floor. The panels are bolted together through holes in the sides of the uprights. At the corners

Lyon Metal Booth Installed in Shop

the upright members are bolted to a 2 in. by 2 in. by ⅛ in. angle, making a rigid unit.

Self-Oiling All Geared Gang Drill

A SELF-OILING, all geared drilling and tapping machine, made in 2, 3 and 4-spindle units has been developed by the Barnes Drill Company, Rockford, Ill. All bearings, aside from the spindle sleeves and cross



Barnes 22-In. Gang Drill Made in 2-, 3- and 4-Spindle Units

spindles, are continuously oiled automatically, oil being forced by a geared pump in the reservoir of each machine to all gears and bearings, including the crown gears and feed box. Transmission gears, aside from the friction clutch gears and including the crown gear and pinion, are cut from a special high grade chrome nickel steel, heat treated and tempered to reduce wear and to increase strength and stiffness. This steel has a high tensile strength and the transmission gears are therefore able to resist severe stresses.

There are eight changes of speed for each spindle, all controlled by levers within easy reach of the operator from his position in front of the drill. Each spindle may be stopped by placing its shifter lever on neutral position or by throwing out the driving clutch. With one to one crown gearing, speeds from 58 to 575 r.p.m. are available. For tapping, two to one crown gears are used, giving eight speeds from 28 to 280 r.p.m.

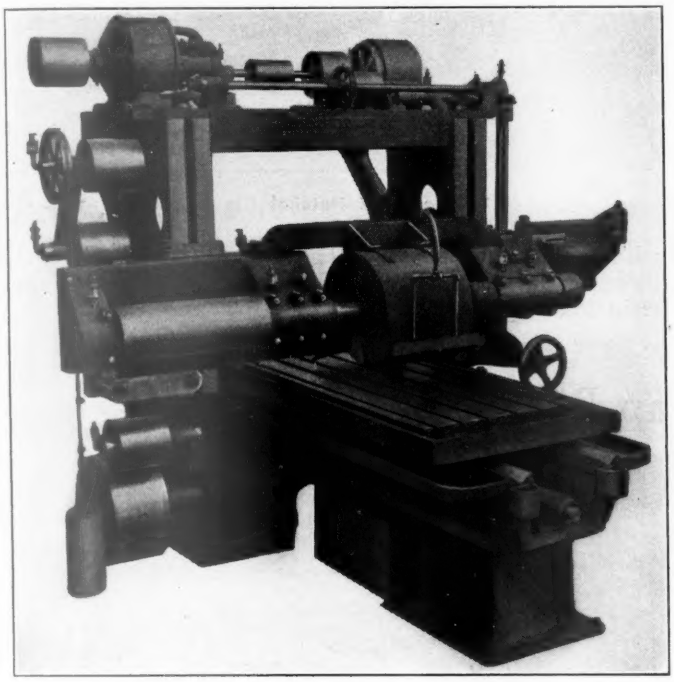
Any or all spindles may be equipped with an automatic reversing mechanism, particularly desirable for depth tapping. The trip can be set so that the instant the tap reaches the depth required, the spindle will automatically reverse. Again, the shifting lever can be set so that when tripped automatically (or by hand) it will return to neutral position, thus stopping the spindle instantly instead of reversing it. The small hand trip lever, shown, is always ready for instant use if desired to reverse or stop the spindle at any point in the operation. If the automatic reverse is not required, drills can be furnished with a plain hand reverse lever instead.

The Barnes gang drill is designed to drive ½ in. to 2 in. high speed drills in solid steel. The height of the machine is 85½ in. The distance from the center of the spindle to

the face of the column is 11 in. and from center to center of spindles (2- and 3-spindle machine) is 28 in. The center spindles of 4-spindle machines are 40 in. apart. The spindle travel is 14 in. The ratio of back gearing is four to one and the vertical travel of the table is 23 in. The speed of tight and loose pulleys is 500 r.p.m. Ten, 15 and 20-hp. motors are recommended for driving the 2, 3 and 4-spindle machines, respectively.

Oscillating Surface Grinding Machine

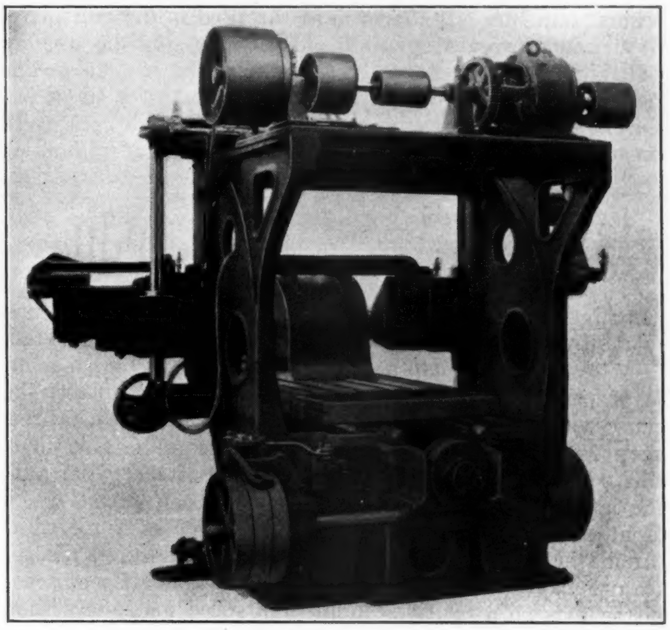
THE oscillating surface grinder, illustrated, has been arranged for motor drive and designed for heavy duty by the Springfield Manufacturing Company, Bridgeport, Conn. This machine is of heavy and substantial construction, carrying two wheels 20 in. in diameter and 6½ in. wide, on a spindle of 3½ in. in diameter. The spindle operates in bearings 3½ in. in diameter, by 18 in. in length.



Heavy Duty Oscillating Surface Grinder

One of the principal features of the machine is its direct motor application to an oscillating motion of the spindle, and this is accomplished by using a drum on the spindle and holding the belt stationary. The drum pulley is connected directly to the spindle and the whole mechanism is oscillated back and forth by means of a crank motion shown on the right hand end of the cross rail slides.

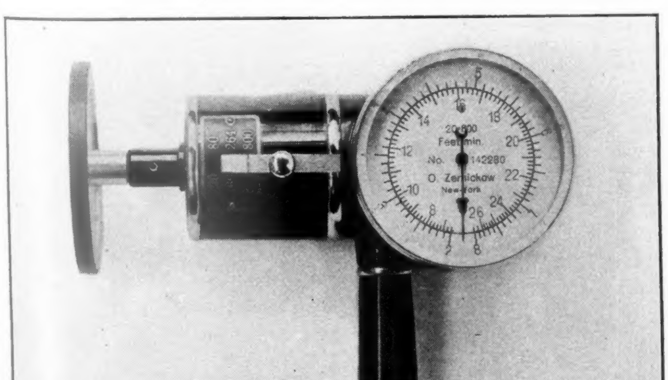
The machine shown has a capacity to grind 5 ft. long, 30 in. wide and 18 in. high, taking 52 in. between the uprights. The weight of the machine is 15,645 lb.



Rear View of Surface Grinder Showing Motor Drive Arrangement

Know Your Cutting Feeds and Speeds

IT should be a matter of pride with railroad shop foremen and machinists to know that they are getting from machine tools the maximum feeds and speeds, consistent with machine strength and the quality of work desired. The excuse that there was no ready and accurate means of determining cutting speeds and feeds no longer holds since the advent of a new device made by O. Zernickow, 15 Park Row, New York.



Speed and Feed Recording Device Aids in Increasing Production

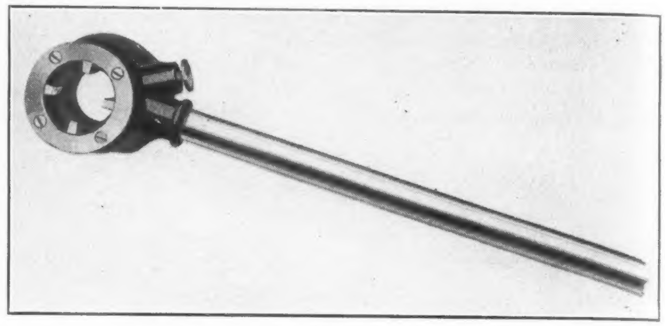
This device, known as the O-Z cutmeter, can be used in determining the cutting speeds of lathes, milling machines, planers, drills, etc.; also for ascertaining the speeds of pulleys, belts and ropes. Its operation depends upon the governor principle and the accuracy of the instrument is not affected by changes in temperature, moisture or magnetic fields. A damping mechanism minimizes the effect of vibration of the indicating hand and also neutralizes the shocks and vibration of the machine under test. This makes readings easy and distinct. Instantaneous readings in ft. per min. are shown and when used with a pointer, rev. per min. No watch is required in calculating the speeds.

The instrument is well balanced and will indicate with equal accuracy in vertical or horizontal positions. Three speed ranges are engaged by shifting a thumb slide shown in the illustration. For each range the full circumference of the dial is available, thus giving a wide space graduation.

Ratchet Die Stock in Close Quarters

THE latest addition to the line of die stocks and pipe cutting tools made by the Borden Company, Warren, Ohio, is the Beaver No. 4 die stock, illustrated, which has been built especially for air line repairing. Air line threading is often difficult work because the pipes are inaccessible and it is impossible to swing a two-handled die stock. This difficulty has been overcome by applying a ratchet handle with a separate die head, as shown, for threading 1¼ in. air line pipe. The die stock is lightweight, sturdy and fool-proof tool, being simply constructed and well balanced. A convenient pawl with a strong spring operates the ratchet in threading and backing off. When desired a 1½ in. outside diameter 12-thread die head for superheater work can be furnished.

Obstructions, such as car bumpers, in no way interfere with the easy operation of the ratchet die stock and it should find ready use in all car repair shops and on cripple tracks where train line pipes have to be threaded in difficult places. It should prove an important aid in increasing the standard of train line maintenance on account of the ease in making necessary repairs. Under present conditions, if a slight leak develops due to a defective thread, where an angle cock makes on to the train line, a new thread cannot be cut without removing clamps, unscrewing the angle cock, disconnecting a pipe coupling somewhere under the car and removing a section of pipe to the shop to be rethreaded. The result of this condition is to put a premium on careless inspection since it is the inevitable tendency to neglect to report small leaks



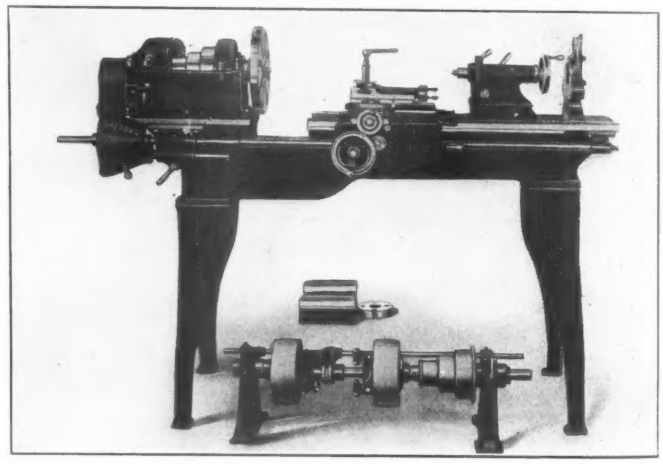
Beaver No. 4 Ratchet Die Stock

which are difficult to repair. The ratchet die stock will enable these repairs to be made easily and thus assist in keeping train lines tight.

Cone Pulley Gap Bed Lathe

AN addition to the line of engine lathes manufactured by the Shepard Lathe Company, Rising Sun, Ind., is the 12 in. gap bed lathe, illustrated. This machine is of particular interest to railroad machine shop men because widely varying diameters have to be turned in railroad shop work and it is a great convenience to be able to do this work on one machine. On account of the gap feature the lathe, illustrated, can swing 19 in. for lengths 5 in. in front of the face plate and thus the range of work which can be handled is greatly increased. In addition, the gap feature makes it possible to turn such work as air compressor piston rods on a relatively light high speed machine without removing the pistons and with a considerable saving in power.

The bed of the lathe is thoroughly reinforced, being designed for greater strength at the gap than at any other point in the bed length. The carriage is so arranged as to overrun the gap without letting down. Power longitudinal and cross feed is provided, and for turning long work, the steady rest shown on the end of the bed can be used. This particular gap bed lathe is driven through a counter shaft and 3-step cone pulley, but electric motor, geared head drive can be furnished if desired.



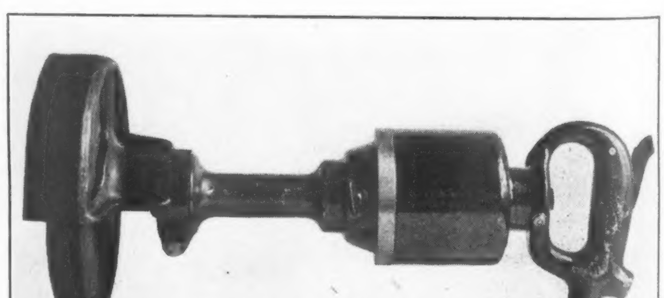
Shepard 12-Inch Gap Bed Lathe

Rotary Piston Pneumatic Grinder

A PORTABLE pneumatic grinder, recently designed and built by the Keller Pneumatic Tool Company, Chicago, is a radical departure from common practice in making portable grinders.

The motor is a rotary piston type, developing a high speed for grinding, with ample power to maintain the speed under load. No crank shaft or toggles are employed and the piston and connecting rod thrust are in a straight line at all times, eliminating toggle trouble, vibration and wear.

The new Keller grinders are built in two sizes, the smaller weighing but 5¾ lb. and the larger 18 lb. As will be noted in the illustration, the tool is well proportioned and balanced, being easily controlled by means of the grip trigger. The absence of vibration insures endurance in operator and tool.



Keller Rotary Piston Pneumatic Grinder Combines Power and Speed

Railway Mechanical Engineer

(Formerly the **RAILWAY AGE GAZETTE, MECHANICAL EDITION** *with which the* **AMERICAN ENGINEER** *was incorporated)*

PUBLISHED ON THE FIRST THURSDAY OF EVERY MONTH BY THE
SIMMONS-BOARDMAN PUBLISHING COMPANY

EDWARD A. SIMMONS, *President* HENRY LEE, *Vice-President and Treasurer*
L. B. SHERMAN, *Vice-President* SAMUEL O. DUNN, *Vice-President*
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WOOLWORTH BUILDING, NEW YORK, N. Y.
F. H. THOMPSON, Business Manager, CLEVELAND

Chicago: Transportation Bldg. Cleveland: 4300 Euclid Ave.
Washington: Home Life Bldg. Cincinnati: First National Bank Bldg.
London: 34 Victoria Street, Westminster, S. W. 1.
Cable Address: Urasigmec, London

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Entered at the Post Office at New York, N. Y., as mail matter of the second class.

Subscriptions, including the eight daily editions of the Railway Age, published in June, in connection with the annual conventon of the American Railway Association, Mechanical Division, payable in advance and postage free: United States, Canada and Mexico, $4.00 a year; elsewhere $5.00, or £1 5s. 0d a year. Foreign subscriptions may be paid through our London office, 34 Victoria street, S. W. 1, in £ s. d. Single copy, 35 cents.

WE GUARANTEE, that of this issue 9,300 copies were printed; that of these 9,300 copies, 8,010 were mailed to regular paid subscribers; 8 were provided for counter and news company sales; 261 were mailed to advertisers; 32 were mailed to employees and correspondents, and 989 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 58,700, an average of 9,783 copies a week.

The *Railway Mechanical Engineer* is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.)

The Illinois Central recently organized a committee of officers and employees to act as a General Fuel Conservation Committee. J. F. Porterfield, general superintendent of transportation, has been appointed chairman of the committee.

The Great Northern has abolished its Havre division. The lines of this division from Havre, Mont., to Cut Bank have been added to the jurisdiction of the Montana division, and the lines from Pacific Junction to Gibson, Great Falls to Shelby and Virden to Sweet Grass, Mont., have been added to that of the Butte division.

The hearing before an examiner of the Interstate Commerce Commission regarding the expenditures of the Pennsylvania Railroad for locomotive repairs made by the Baldwin Locomotive Works was resumed at Washington on May 9. J. T. Wallis, chief of motive power, was the principal witness. Announcement has been made that oral arguments on this case will be held at Washington on June 20.

The Missouri Pacific has abolished its Valley division, and has assigned the Pine Bluff district from Little Rock, Ark., to McGehee, to the Arkansas division, the McGehee district, from McGehee to Monroe, La., and the Hamburg district to the Louisiana division, and the Lake Providence district, the Eudora district and the Arkansas City and Warren branches to the Memphis division.

Tabular summaries of accidents occurring in the transportation of explosives and other dangerous articles during the first quarter of 1921 are shown in accident bulletin No. 51 of the Bureau of Explosives. The most serious catastrophe during this period was the casinghead gasolene explosion at Memphis, Tenn., on January 24 which caused thirteen deaths and a property loss of about $150,000. The bulletin also includes suggestions on reporting violations of the regulations, accidents, damages, etc., and describes several accidents, notably a fire caused by loading pyroxylin plastic articles against steam pipes in an express car.

Bird M. Robinson, president of the American Short Line Association, says that about 75 per cent of the employees of the short lines of the country have accepted reductions in wages. The amount of the reductions is not known with precision, but Mr. Robinson thinks the percentages were as great, and perhaps in some cases greater than, the reductions proposed by the larger railroads. It is said that nineteen disputes now before the Railroad Labor Board involve "short lines," and Mr. Robinson plans to go before the Board and show that that body has no jurisdiction of roads which were not operated by the government during the war.

Locomotive Orders

The American Locomotive Company has been given an order for 42 locomotives of the Pacific, Mikado and Mallet types for the Pekin-Kalgan Railway, China. Of the 42 engines there will probably be seven to ten Mallet type locomotives. Each locomotive and tender will weigh 640,000 lb. in working order.

American Specifications for France

The United States Department of Commerce is now translating into French, for publication in a French-English edition, 62 specifications of the American Society for Testing Materials particularly applicable to export trade. These specifications include those for rails and splice bars, structural and reinforcing steels, steel forgings and castings, steel wheels and tires, steel and iron tubes and pipe, boiler steels, wrought-iron products, pig iron, cast-iron pipe, malleable and gray-iron castings, copper wire, copper bars, spelter, bronze, cement, linseed oil and turpentine. These same specifications were translated into Spanish two years ago, and have since been distributed among consular offices and elsewhere in South America.

New Rules for Classification of Employees

New rules governing the classification of employees for statistical and reporting purposes, to go into effect on July 1, have been issued by the Interstate Commerce Commission. They provide for more detailed reports than have hitherto been required. The resulting statistics are intended to meet the needs of both the Railroad Labor Board and the Interstate Commerce Commission. The classification is made largely in accordance with the recommendations of the director-general of railroads. It is requested that duplicate copies of the reports be sent to the Labor Board. There will be 148 classes of employees, in place of the 68 classes heretofore used by the commission. The number of employees is to be counted 12 times a year as of the fifteenth of the month, with additional counts for certain occupations.

Rock Island Consolidates Divisions

The Chicago, Rock Island & Pacific has consolidated divisions, as follows: That part of the Minnesota division between Cedar Rapids and St. Paul-Minneapolis, and between Vinton, Iowa Falls, has been consolidated with the Cedar Rapids division, the consolidated division to be known as the Cedar Rapids-Minnesota division. That part of the Minnesota division between Vinton, Iowa, and Iowa Falls, has been consolidated with the Cedar Rapids division, the consolidated division to be known as the Cedar Rapids-Minnesota division. That part of the Minnesota

division between Manly, Iowa, and Short Line Junction has been consolidated with the Dest Moines Valley division. The Colorado division has been consolidated with the Nebraska division, and is to be known as the Nebraska-Colorado division. The St. Louis division has been consolidated with the Kansas City terminal division, and is to be known as the St. Louis-Kansas City division. The Louisiana divison has been consolidated with the Arkansas division, and is to be known as the Arkansas-Louisiana division. The Indian Territory division has been consolidated with the Panhandle division, and is to be known as the Panhandle-Indian Territory division. The Amarillo division has been consolidated with the El Paso-Mexico division, the new division to be called the El Paso-Amarillo division.

Program for Annual Meeting of Mechanical Division A. R. A.

The Mechanical Division of the American Railway Association has issued a program for the business meeting to be held at the Drake Hotel, Chicago, June 15 and 16. The sessions will convene at 10:00 a. m. city time, which is 9:00 a. m. central standard time, and continue all of each day with luncheon period 12:30 to 2:00 p. m.

Reports from the following committees will be considered:

WEDNESDAY, JUNE 15.

General Committee.
Committee on Nominations.
Arbitration Committee.
Committee on Prices for Labor and Material.
Committee on Loading Rules.
Committee on Standard Method of Packing Journal Boxes.

THURSDAY, JUNE 16.

Committee on Car Construction.
Committee on Brake Shoe and Brake Beam Equipment.
Committee on Train Brake and Signal Equipment.
Committee on Tank Cars.
Committee on Specifications and Tests for Materials.

Election of officers will be held Wednesday, immediately after report of Nominating Committee is presented.

Advance copies of the reports to be considered will be mailed to the members before the meeting.

Locomotive Boiler Code Adopted by A. S. M. E.

An important step in engineering standardization was taken at the Boston meeting of the council of the American Society of Mechanical Engineers, when it adopted in its final form that portion of the A. S. M. E. Boiler Code known as the Locomotive Boiler Code. This code contains the rules for the construction of locomotive boilers which are not subject to federal inspection and control.

The necessity for such an addition to the Boiler Code arose from the fact that, while the boilers of locomotives operated on railways engaged in interstate service are covered by the construction and inspection rules of the Interstate Commerce Commission, there was found to be a vast mileage of industrial and short-line railroads in operation in the various states, which by virtue of their location, are not subject to the interstate requirements.

As a result of calls for a code to cover the construction of boilers of this class, the Sub-committee on Railway Locomotive Boilers was appointed in 1916. This committee consisted of F. H. Clark, chairman; F. J. Cole, chief construction engineer of the American Locomotive Company; A. L. Humphrey, vice-president and general manager of the Westinghouse Air Brake Company; S. F. Jeter, chief engineer of the Hartford Steam Boiler Inspection & Insurance Company; William F. Kiesel, Jr., mechanical engineer of the Pennsylvania, and H. H. Vaughan, vice-president of the Dominion Copper Products Company, Montreal. The work of this sub-committee was interrupted somewhat by the war, but its preliminary report was submitted to the Boiler Code Committee in April, 1919.

The preliminary report was printed and distributed at the Spring Meeting in Detroit where it was accepted by the meeting. It was thereupon published in the August issue of *Mechanical Engineering*. The sub-committee has been co-ordinating the points of view of all who would be affected by such a code and the final result approved by the main committee and the council is now ready for use. H. V. Wille, assistant to the vice-president of the Baldwin Locomotive Works, and Kenneth Rushton, chief mechanical engineer of the Baldwin Locomotive Works, were brought into the committee and with Mr. Cole and James Partington, estimating engineer of the American Locomotive Company, appointed in place of Mr. Humphrey, resigned, represented the locomotive manufacturers.

Constructive assistance was given by the Mechanical Division of the American Railway Association through its representatives, A. W. Gibbs, mechanical engineer of the Pennsylvania; W. I. Cantley, of the Lehigh Valley; and N. A. Ferrier, of the New York Central. A. G. Pack, chief inspector of the Bureau of Locomotive Inspection, Interstate Commerce Commission, has expressed great interest in the code and with his staff has been in frequent attendance at meetings of the sub-committee.

During the past two years Mr. Clark, the original chairman of the committee, has been in China as Technical Adviser to the Ministry of Communications at Pekin. Mr. Vaughan has carried on the work of the committee as acting chairman.

The code, itself, follows the general form of the Code for Stationary Boilers. The materials to be used and methods of construction of the various braced and stayed surfaces are very carefully specified. Attention is given to the desire of the locomotive builders to maintain the lowest possible weight consistent with strength. As compared with stationary boilers with a safety factor of five the allowable factor for locomotive shells is four. Requirements in the use of safety valves and their method of test are rigid as are the hydrostatic tests specified.

MEETINGS AND CONVENTIONS

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILWAY ASSOCIATION, DIVISION V—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Business meeting June 15 and 16, Hotel Drake, Chicago, Ill.

DIVISION V—EQUIPMENT PAINTING DIVISION.—V. R. Hawthorne, Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION VI—PURCHASES AND STORES.—J. P. Murphy, N. Y. C., Collinwood, Ohio. Convention June 9, 10 and 11, Hotel Blackstone, Chicago, Ill.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago. Convention September 12-14, Hotel Sherman, Chicago, Ill.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—R. D. Fletcher, 1145 E. Marquette Road, Chicago. Convention August 9, 10 and 11, Hotel Sherman, Chicago, Ill.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, University of Pennsylvania, Philadelphia, Pa. Annual meeting June 20 to 24, inclusive, New Monterey Hotel, Asbury Park, N. J.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio. Annual convention September 19-24, Indianapolis, Ind.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—W. A. Booth, 131 Charron St., Montreal, Que. Meeting second Tuesday of each month except June, July and August, at Windsor Hotel, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, New Morrison Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—Thomas B. Koeneke, 604 Federal Reserve Bank Building, St. Louis, Mo. Meetings first Tuesday in month at the American Hotel Annex, St. Louis, Mo.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York, N. Y.

CHIEF INTERCHANGE CAR INSPECTORS AND CAR FOREMEN'S ASSOCIATION.—W. P. Elliott, T. R. R. A. of St. Louis, East St. Louis, Ill.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meeting second Tuesday of February, May, September and November, at Hotel Sinton, Cincinnati.

DIXIE AIR BRAKE CLUB.—E. F. O'Connor, 10 West Grace St., Richmond, Va.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 715 Clarke Ave., Detroit, Mich. Next meeting August 16, 17 and 18, 1921, Hotel Sherman, Chicago, Ill.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. G. Crawford, 702 East Fifty-first St., Chicago, Ill.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabasha Ave., Winona, Minn. Convention, September 12, 13, 14 and 15, 1921, Hotel Sherman, Chicago, Ill.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Meeting second Tuesday of each month, except June, July, August and September.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York, N. Y.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgrebe, 623 Brisbane Building, Buffalo, N. Y.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Meeting second Friday of each month, except June, July and August.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 14 E. Jackson Boulevard, Chicago. Meeting third Monday of each month, except June, July and August.

PERSONAL MENTION

GENERAL

W. P. KERSHNER, who has been appointed superintendent of motive power of the International & Great Northern, with headquarters at Palestine, Tex., was born at West Leesport, Pa., August 16, 1885. He graduated from high school at Reading, Pa., in 1901, and began his railroad career as a night caller, for the Philadelphia & Reading. Shortly thereafter he became a machinist apprentice and later a machinist for the Reading, and resigned to attend the University of Pennsylvania, from which he graduated in 1908. He then entered the employ of the Louisville & Nashville at South Louisville, Ky., as a layer-out on new engines. Later he served the Chicago & North Western in the office of the mechanical engineer. He left that position to go with the Northern Pacific at Livingston, Mont., and shortly afterward resigned to enter the service of the Chicago, Milwaukee & St. Paul at Lombard, Mont. Later he became general foreman for the Oregon Short Line, at Montello, Idaho. He next became a hydraulic engineer for the Bishop Creek Mining Company at Laws, Cal., but soon afterward entered railroad service again—this time as a drop-pit foreman for the Southern Pacific. Subsequently he was in the employ of the Texas & Pacific, the International & Great Northern and the Missouri, Kansas & Texas. During the war Mr. Kershner served as second lieutenant, captain and major in the engineers and saw 17 months' service overseas. After his discharge from the service he went to the Texas & Pacific as general mechanical inspector and was later promoted to shop superintendent. A few months later he left this position to become master mechanic of the International & Great Northern at Palestine, Tex., which position he held at the time of his recent appointment.

FRANK S. ROBBINS, formerly master mechanic of the Pennsylvania at Pittsburgh, has been appointed mechanical advisor to the Chinese Eastern Railway, which is a part of the Trans-Siberian System. He will serve under the direction of J. F. Stevens, president of the Inter-Allied Technical Board of the Orient. Mr. Robbins was born at Menantico, N. J., December 22, 1880, and was educated at Purdue University. Upon graduation in mechanical engineering he entered railroad work as a machinist apprentice with the Union Railroad in New Jersey. He later entered the Altoona shops of the Pennsylvania Railroad as special apprentice and upon completion of this course was appointed motive power inspector at the West Erie shops. In 1909 he was appointed assistant master mechanic of the Monongahela division, and, in 1911, assistant road foreman of engines, Renova, Pa. In 1912 he was appointed assistant general foreman of the car shops at Pitcairn, Pa., and in 1913 was promoted to master mechanic of the Pittsburgh division.

In 1917, Mr. Robbins entered military service and was commissioned a captain in the Railway Engineers, being assigned to command Company D of the 19th Engineers (Railway). While a member of the American Expeditionary Forces in France his railroad experience was of considerable assistance in constructing railway shops at Bassens and organizing the personnel for their operation. He was appointed superintendent of motive power of "D" line and as a result of his work was promoted to the rank of major of engineers. In 1919, Major Robbins was discharged from military service and was appointed assistant engineer, maintenance of equipment, in the office of the assistant to the president of the Pennsylvania at Philadelphia. In December, 1919, he was appointed master mechanic of the Pittsburgh division, which position he held until the reorganization of the Pennsylvania. Upon the return of the roads to their owners, Mr. Robbins was appointed master mechanic of the new Pittsburgh Terminal division. On March 15, 1921, he resigned his position with the railroad company to serve with the Inter-Allied Technical Board. Mr. Robbins' headquarters in his new position will be at Harbin. Manchuria.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

E. C. HUFFMAN, superintendent of the Great Northern, with headquarters at Breckenridge, Minn., has been appointed master mechanic of the Sioux City division, with headquarters at Sioux City, Ia., succeeding F. J. Fero, deceased.

T. E. PARADISE, assistant superintendent of motive power of the Chicago, Burlington & Quincy, with headquarters at Lincoln, Neb., has been appointed master mechanic, with headquarters at Hannibal, Mo., succeeding H. Modaff, who has been transferred to Ottumwa, Ia. Mr. Paradise was born on November 22, 1880, at Peoria, Ill., and entered the employ of the Chicago, Burlington & Quincy as a machinist apprentice in October, 1899. In April, 1902, he enlisted as a machinist in the navy, and in January, 1907, returned to the Chicago, Burlington & Quincy. From 1913 to August, 1916, he was roundhouse foreman at Grand Crossing, Wis.; from August, 1916, to April, 1917, master mechanic at Centerville, Ia.; from April, 1917, to September, 1918, master mechanic at Hannibal; from September, 1918, to March, 1920, mechanical assistant to regional director, Central Western Region; and from March, 1920, to May 1, 1921, assistant superintendent of motive power, Lines West. The position of assistant superintendent of motive power at Lincoln has been abolished.

J. F. SPEIGLE has been appointed assistant master mechanic of the Canadian National, with headquarters at Hornepayne, Ont., succeeding W. G. Strachan, who has been transferred to Capreol, Ont.

H. D. TURNER, master mechanic of the Chicago, Burlington & Quincy at Ottumwa, Ia., has been appointed road foreman of engines, with headquarters at Burlington, Ia.

CAR DEPARTMENT

DAVID M. RANKIN has been appointed car foreman of the Chicago, Rock Island & Pacific at Dalhart, Tex., succeeding Robert L. Ridling.

SHOP AND ENGINEHOUSE

PAUL J. SCHENCK has been appointed general foreman of the Chicago, Rock Island & Pacific shops at Dalhart, Tex., succeeding James McLeod.

C. E. SHOUP has been appointed general foreman of the New York Central at Englewood, Ill.

LEE STANFORD has been appointed roundhouse foreman of the Santa Fe at Gallup, N. M.

CLARENCE WHITE has been appointed general foreman of the Santa Fe at Newton, Kan.

J. A. WOODS has been appointed foreman of the Atchison, Topeka & Santa Fe at Bagdad, Cal., succeeding C. J. McCue. Mr. McCue has been made general roundhouse foreman at Needles, Cal.

PURCHASING AND STOREKEEPING

W. H. KING, JR., whose appointment as general purchasing agent of the Seaboard Air Line was announced in the May issue of the *Railway Mechanical Engineer*, was born on April 20, 1883, at Portsmouth, Va. His education was continued through high school and preparatory school. In 1900 he entered railway service with the Seaboard Air Line as a clerk in the accounting department. Two years later he became a clerk in one of the company's agencies, and the following year became a clerk and statistician in the accounting department. In 1910 he was appointed assistant statistician in the operating department, and, in 1912, chief statistician and fuel agent. He was promoted to chief statistician in 1913 and four years later became the assistant to the president and federal manager, and also general manager of subsidiary lines. He was appointed assistant to the vice-president, and vice-president of the Baltimore Steam Packet Company in 1920, which position he held at the time of his recent appointment.

J. E. MAHANEY, general storekeeper of the Seaboard Air Line, has been appointed superintendent of stores of the Chesapeake & Ohio, with headquarters at Huntington, W. Va.

R. M. NELSON, purchasing agent of the Chesapeake & Ohio, has been appointed assistant to the director of purchases and stores, with headquarters at Richmond, Va. The position of purchasing agent has been abolished.

W. J. SIDEY, general storekeeper of the Buffalo, Rochester & Pittsburgh, has been assigned other duties and the position of general storekeeper has been abolished. Officers and employees heretofore reporting to the general storekeeper will report to the chief engineer.

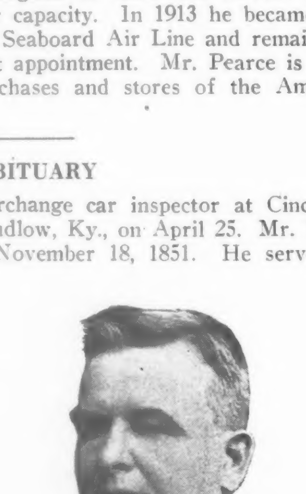
H. C. PEARCE, general purchasing agent of the Seaboard Air Line, has resigned to become director of purchases and stores of the Chesapeake & Ohio and the Hocking Valley, with headquarters at Richmond, Va. Mr. Pearce was born on June 1, 1867, at Westberry, Quebec, and was graduated from St. Charles - Baromme College at Sherbrooke, Quebec. He entered railway service in 1885 as a clerk in the office of superintendent of the Minneapolis, Lyndale & Minnetonka and subsequently served as a material clerk and conductor on the same line. In 1887 he went with the Minneapolis, St. Paul & Sault Ste. Marie as a clerk to the superintendent of construction. He later served as a clerk in the auditor's office, chief clerk to general super-

H. C. Pearce

clerk to general superintendent, general storekeeper and purchasing agent. He went with the Chicago, Rock Island & Pacific in April, 1903, as assistant purchasing agent. The following year he was appointed general storekeeper and remained in that position until 1906, when he resigned to enter the service of the Southern Pacific in a similar capacity. In 1913 he became general purchasing agent of the Seaboard Air Line and remained in that position until his present appointment. Mr. Pearce is chairman of the division of purchases and stores of the American Railway Association.

OBITUARY

HENRY BOUTET, chief interchange car inspector at Cincinnati, Ohio, died at his home in Ludlow, Ky., on April 25. Mr. Boutet was born in Cincinnati on November 18, 1851. He served his apprenticeship with the Mowry Car Works and then entered the car department of the Pennsylvania railroad, with which road he remained for five years. He then entered the service of the Cincinnati Southern as a car builder and was later promoted to foreman of the car department at Ludlow where he remained nine years, when he was appointed chief interchange car inspector, which position he held until his retirement September 1, 1920, on account of failing health. Mr. Boutet was a member of the Master Car Builders' Associa-



H. Boutet

tion and Chief Interchange Car Inspectors' and Car Foremen's Association. He was president of the Chief Interchange Car Inspectors' Association from 1905 to 1911 inclusive. This association was formed at a meeting of chief interchange inspectors which was called by Mr. Boutet in March, 1898, at Cincinnati. He was also secretary of the Cincinnati Railway Club from its organization in July, 1912, until the time of his retirement in 1920.

SUPPLY TRADE NOTES

The Industrial Car Manufacturers' Institute has removed its executive office from Pittsburgh, Pa., to 68 William street, New York City.

The Ralston Steel Car Company has moved its Chicago offices from 20 East Jackson boulevard to the Fisher building, 343 South Dearborn street.

Homer C. Johnstone, formerly with the Midvale Steel Company, now represents the Gould Coupler Company, with headquarters at New York City.

The Galena-Signal Oil Company will remove its New York City office on June 1, from 17 Battery Place to the Liggett building, 41 East Forty-second street.

Raymond R. Bilter, formerly secretary of the Trumbull Waste Manufacturing Company, Philadelphia, Pa., is now associated with the Railway Supply & Manufacturing Company, Cincinnati, Ohio.

V. Z. Caracristi, until recently a member of the Railway & Industrial Engineers, Inc., has opened consulting offices at 43 Broad street, New York. Mr. Caracristi has been identified with the railway and industrial fields for the last twenty-two years. He was at one time shop engineer and maintenance supervisor of the Richmond plant of the American Locomotive Company, and later general maintenance supervisor of all the plants of that company. He was associated as designer and constructor of the Union Station, Washington, D. C., and was assistant to the general superintendent of motive power of the Baltimore & Ohio. He was later in the employ of the Wheeling & Lake Erie, where he carried out improvements in

V. Z. Caracristi

the Brewster shops, and shortly after did similar work in the Watervliet shops and Carbondale terminal of the Delaware & Hudson. He also supervised the layout, design and equipment of extensions to the plant of the Lima Locomotive Works, Inc. From 1913 to 1919, Mr. Caracristi was engaged in consulting work for banking interests and during this period devoted considerable effort to development work on the burning of pulverized fuel in suspension. In 1919, with J. E. Muhefeld, he formed the Railway & Industrial Engineers, Inc. Mr. Caracristi will specialize in consulting work in railroad and shop design, operation and betterment.

The H. K. Ferguson Company, Cleveland, Ohio, has removed its Chicago office from the Rookery building to 1637 Monadnock Block. O. C. F. Randolph remains in charge of the Chicago territory.

W. F. Robinson, for many years connected with James B. Sipe & Co., Pittsburgh, Pa., has been appointed manager of the railroad sales department of the Tropical Paint & Oil Company, Cleveland, Ohio.

The Ross Heater & Manufacturing Company, Inc., Buffalo, N. Y., has opened a branch office at 2 Rector street, New York City, and has discontinued its sales agency. The new office is in charge of C. M. Hardin, who was formerly located at the home office.

Clement F. Street, formerly vice-president of the Locomotive Stoker Company, has opened an office in the Smith building,

Greenwich, Conn., for the purpose of placing on the market the Street locomotive starter for application to locomotive trailer trucks and tenders.

The Automatic Coupler & Trailer Equipment Company, 954 West Twenty-first street, Chicago, has been incorporated with a capital of $100,000, by Norman T. Brenner, Meyer B. Mervis and Charles A. Holland, to manufacture railroad and other heavy mechanical equipment.

Ralph S. Cooper, vice-president and general sales manager of the Independent Pneumatic Tool Company, 600 West Jackson boulevard, Chicago, has been appointed general manager in addition to his other duties. Mr. Cooper has just returned from Europe, where he has established branch offices and agencies for the company.

J. M. Davis, formerly vice-president of the Baltimore & Ohio, has been elected president of Manning, Maxwell & Moore, Inc., 119 West Fortieth street, New York City, to succeed the late A. J. Babcock. Mr. Davis was born on November 5, 1871, and began railway work in 1888, as a freight brakeman on the San Antonio & Aransas Pass. From September, 1891, to 1900, he served consecutively as stenographer to the superintendent of the Gulf, Colorado & Santa Fe, chief clerk to the superintendent of the Mexican Central, clerk in the general manager's office of the Great Northern, assistant superintentdent and later superintendent of the Great Northern. In 1900, he went to the Erie as superintendent at Scranton, Pa., subsequently serving as superintendent of the Union Steamboat Line of the Erie, at Buffalo, N. Y., and as superintendent of the Allegheny division of the Erie. He returned to the Great Northern in 1903, as superintendent, and in 1905 was promoted to assistant general superintendent of the Central district. In 1907 he went to the Oregon Short Line as assistant general superintendent, and was subsequently made acting general superintendent and later general superintendent. In 1910 he was appointed general superintendent of the Central district of the Southern Pacific, with headquarters at San Francisco, Cal. He entered the service of the Baltimore & Ohio on January 1, 1914, as assistant general manager at Cincinnati, Ohio, of the Baltimore & Ohio Southwestern-Cincinnati, Hamilton & Dayton, and later in the same year was promoted to general manager of these lines. In July, 1916, he was appointed vice-president in charge of operation and maintenance of the Baltimore & Ohio System, with headquarters at Baltimore, Md., and held that position until July 1, 1918, when, under federal control of the railroads, he was appointed manager of the New York properties of the Baltimore & Ohio, including the Station Island lines. In September, 1919, he left the Baltimore & Ohio to become president of the Rock Hill Iron & Coal Company and associated corporations, including the East Broad Top Railroad & Coal Company, with office at New York.

J. M. Davis

The Keller Pneumatic Tool Company announces the removal of its Chicago branch to larger and more up-to-date salesrooms and service station. This branch is now located on the main floor in the Transportation building, 624 South Dearborn street, Chicago, where a complete stock of tools and parts will be maintained.

Fred H. Dorner, Wells building, Milwaukee, Wis., has been appointed sales representative for the American Spiral Spring & Manufacturing Company in Wisconsin and the northern peninsula of Michigan. McCreery & Taussig, Railway Exchange building, St. Louis, Mo., have been appointed sales representatives for the company in Missouri and southern Illinois.

The Jones & Laughlin Steel Company of Pittsburgh, Pa., has purchased 15 acres of ground with a 2,700-ft. frontage on Lake Michigan, just east of the Illinois-Indiana state line, near Chicago. This company already owns other land in the Calumet district and it is reported that plans are being made to build a steel plant in that district.

Robert L. Bridgman, New England representative of the L. S. Starrett Company, Athol, Mass., died suddenly on May 7, at the age of 87, at his home in Belchertown, Mass. Previous to 1908, when he became connected with the L. S. Starrett Company as New England representative, Mr. Bridgman served for over 30 years as representative of the Athol Machine Company.

Last January the interests, along with all patents and patent rights, of the Duntley Pneumatic Tool Company were acquired by the H. O. King Company, engineers and tools makers of Chicago, at which time Mr. King, president of the H. O. King Company, organized the Duntley-King Pneumatic Tool Company. This new company is now in production on a full line of pneumatic tools and accessories, with general offices and factory at 1143 Diversey Parkway, Chicago.

J. A. Rittenhouse, superintendent of the Pullman Company, with headquarters at Philadelphia, Pa., has been transferred to Detroit, Mich., with jurisdiction over the Detroit, Buffalo and Cleveland districts. W. A. Hartley, assistant to the assistant general manager, with headquarters at Philadelphia, Pa., has been given jurisdiction over car movements and other matters local to the Philadelphia district. J. T. Ramsom, assistant general manager, with headquarters at Washington, D. C., has been given jurisdiction over all matters general in character, affecting the Philadelphia district.

E. C. Sattley, associated for 20 years with the Page Steel & Wire Company at Pittsburgh and Monessen, serving a large part of the time as general manager, has joined R. J. Jones, formerly manager, and Oliver G. Boyd, formerly secretary, of the Tube & Pipe Supply Company, in forming a new corporation under the name of the Iron & Steel Products Company, with offices at 230 Fifth avenue, Pittsburgh, Pa. The new organization will continue the business heretofore conducted by the Tube & Pipe Supply Company. E. C. Sattley is president, R. J. Jones, vice-president, and Oliver G. Boyd, secretary and treasurer of the new company.

Wilber Eckels has been appointed western sales manager, with headquarters in the People's Gas building, Chicago, for the Standard Coupler Company, New York. Mr. Eckels graduated from Pennsylvania State College with the degree of mechanical engineer and has been with the Standard Coupler Company since 1912, with the exception of one year when he served as lieutenant in the 35th Engineers, A. E. F., in France and England. E. G. Goodwin has been appointed chief engineer of the same company, with headquarters at New York; vice R. D. Gallagher, Jr., resigned. Mr. Goodwin received his technical education in the Virginia Polytechnic Institute and has been connected with the Norfolk & Western in its engineering department for eleven years.

Harry W. Finnell has become connected with the sales department of the Automatic Straight Air Brake Company, with headquarters at the company's general offices, 210 Eleventh avenue, New York City. Mr. Finnell served with the Chicago Railway Equipment Company from 1906 to 1909 as railway sales manager and later became assistant to president of the Carbon Steel Company, Pittsburgh, Pa. In 1914, he was appointed general manager of the Henry Giessel Company, Chicago, and during 1915 and 1916 was vice-president of Templeton, Kenley & Co., Ltd., Chicago. He was manager of the War Industries Bureau for Illinois, and was also affiliated with the War Industries Board, since which time he has been in the export business.

Homer J. Forsythe, manager of the construction division of the engineering department of E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del., has been transferred to the position of assistant general manager of the Hyatt Roller Bearing Company, Newark, N. J., a subsidiary of the General Motors Corporation. Mr. Forsythe has a wide experience in machine shop work, having been with the engineering department of the Du Pont Company since August, 1906, when he began work at the Wilmington office as estimator. Later he held executive positions at the Brandywine shops, Wilmington, and during the war

he was made manager of the combined Wilmington shops which were engaged in the construction of material for the war plants. Since the war, Mr. Forsythe served as manager of the construction division of the engineering department.

Page Steel & Wire Company

A. P. Van Schaick has been appointed general manager of sales of the Page Steel & Wire Company, with headquarters in the Grand Central Terminal, New York, succeeding C. E. Sattley, resigned. Mr. Van Schaick began his business career in 1903, at which time he left Williams College, Williamstown, Mass., to enter the railroad sales department of the Pittsburgh Plate Glass Company, with headquarters in Chicago. From 1906 to 1910 he was in the employ of the Universal Railway Supply Company, with headquarters in the same city, resigning from that position during the latter year to become district sales manager of the Lackawanna Steel Company at Chicago. In May, 1919, he went to the American Chain Company, Inc., Bridgeport, Conn., as special representative, with headquarters in Chicago, and subsequently was appointed assistant general manager of sales of the same company at New York. On January 1, 1921, he was promoted to general manager of sales of the American Chain Company and other subsidiary companies, and now becomes also general manager of sales of the Page Steel & Wire Company. Mr. Van Schaick has been active in the work of railway supply organizations and especially of the national Railway Appliances Association. He was elected a member of the executive committee of this association in 1910, vice-president in 1911, and president the following year.

A. P. Van Schaick

W. T. Kyle

W. T. Kyle, who has been appointed assistant general manager of sales of the Page Steel & Wire Company, was born in 1883, at Baltimore, Md. He was educated in the high schools and took academic courses in various academies, specializing in civil engineering. In 1901 he began an apprenticeship course with the Bell Telephone Company at Philadelphia, Pa., and two years later went with the American Pipe & Construction Co., Philadelphia, as district superintendent, on general railroad construction work. He left that position in 1908, to go to the Duplex Metals Company, New York, as a salesman, and later became sales manager of the same company. In 1914 he went to the Okonite Company as special representative at New York. In 1916 he entered the service of the Page Steel & Wire Company as sales manager of its Armco wire department at New York and on April 1 was promoted to assistant general manager of sales, with headquarters at New York. All the company's general sales are now handled at New York for both the Adrian, Mich., and the Monessen, Pa., plants. Mr. Kyle served in 1917 and 1918 as chairman of the Railway Signal Appliance Association, and is now chairman of the Railway Telegraph & Telephone Appliance Association.

TRADE PUBLICATIONS

COXE STOKER.—The Coxe stoker is described and fully illustrated in a 29-page booklet issued by the Combustion Engineering Corporation, New York. The results of economy and capacity tests on 1,000 hp. units are given, also coal analyses.

EASY-CUT GROUND TAPS.—John Bath & Co., Inc., Worcester, Mass., has recently issued an 8-page bulletin describing a precision tap which removes metal easily and produces an accurate threaded hole. A table of sizes established by the National Screw Thread Commission on Taps is included.

STELLITE.—A new method of obtaining increased cutting speed, the latest advances in machine-tool practice, heat charts, tables and other data concerning Stellite tools, are included in two new textbooks recently issued by the Haynes Stellite Company, New York. The books are of convenient pocket size and are well illustrated.

LATERAL.—The cause and effect of lateral play, also its remedy, are taken up in a clear and comprehensive manner in Catalogue No. 6, recently issued by the Smith Locomotive Adjustable Hub Plate Company, Chicago. Illustrations and a chart, showing the design of plate, width of bore, and other details of application, complete the book.

BORING MACHINES.—An instruction booklet, issued recently by the Universal Boring Machine Company, Hudson, Mass., contains 37 pages devoted to the setting up, leveling and operation of Universal horizontal boring machines made by this company. Detailed illustrations show the possible adjustments and proper methods of operating these machines with red arrows indicating the cautions to be observed.

AUTOMATIC LOWERING JACKS.—The Duff Manufacturing Company, Pittsburgh, Pa., is distributing a new bulletin, No. 308, which illustrates and describes their line of automatic lowering jacks. This type of jack, which is made in a wide variety of heights, especially suitable for use in car repair shops and bridge work, is adapted for raising loads of any kind where a lifting capacity of 25 tons or less is required.

VANADIUM.—A 50-page book on Vanadium, In War and Peace, has been issued by the Vanadium Corporation of America, New York. After a brief outline of the early history of vanadium and an interesting description of the ore supply at Mina Ragra, Peru, numerous illustrations and suggestions for the application of the finished product are given, also two charts showing the physical properties of vanadium steel at different draw-back temperatures.

ALLOY STEELS.—Joseph T. Ryerson & Son, Chicago, have recently published a 95-page booklet on the heat treatment of alloy steels, entitled "The Ryerson Handbook on Alloy Steels." The book is written in an accurate and interesting, but non-technical style, and covers in separate chapters the quality, manufacture, heat treating and testing of alloy steels, as well as many other features, including a description of quenching equipment, furnaces, etc., and specifications.

WATER SOFTENERS.—Refinite, a substance for softening water in textile mills, laundries, institutions, hotels, etc., and the Booth lime soda water softener, especially adapted for the use of railroads, municipalities, and the larger steam power and central heating plants, are each described in detail in separate treatises recently issued by the Refinite Company, Omaha, Neb. A number of illustrations showing the construction and typical installations of each of these systems are contained in these catalogues.

GRINDING MACHINES.—A general description, specifications, illustrations and lists of attachments and repair parts for Bath Universal grinding machines are given in a well-arranged catalogue of 18 pages recently issued by the Universal Grinding Machine Company, Fitchburg, Mass. The massive proportions of the bed, column, knee, table, etc., the wide range of work and traverse speeds, liberal bearings, the accuracy of the automatic feeds, and the centralized location of operation at the front of table are some of the interesting features explained.